

# Curlew Valley Subbasin Assessment and Total Maximum Daily Loads

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2019

Hydrologic Unit Code 16020309



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Department of Environmental Quality**

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# **Curlew Valley Subbasin Assessment and Total Maximum Daily Loads**

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**April 2019**

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## Abbreviations, Acronyms, and Symbols

<b>§303(d)</b>	refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section	<b>ms/cm<sup>2</sup></b>	millisecond per square centimeter
<b>μ</b>	micro, one-one thousandth	<b>MOS</b>	margin of safety
<b>§</b>	section (usually a section of federal or state rules or statutes)	<b>MSGP</b>	multi-sector general permit
<b>AU</b>	assessment unit	<b>n/a</b>	not applicable
<b>BLM</b>	United States Bureau of Land Management	<b>NB</b>	natural background
<b>BMP</b>	best management practice	<b>NPDES</b>	National Pollutant Discharge Elimination System
<b>BURP</b>	Beneficial Use Reconnaissance Program	<b>NTU</b>	nephelometric turbidity unit
<b>C</b>	Celsius	<b>PCR</b>	primary contact recreation
<b>cfs</b>	cubic feet per second	<b>SCR</b>	secondary contact recreation
<b>cfu</b>	colony forming unit	<b>SEI</b>	streambank erosion inventory
<b>CGP</b>	construction general permit	<b>SFI</b>	DEQ's Stream Fish Index
<b>CWA</b>	Clean Water Act	<b>SHI</b>	DEQ's Stream Habitat Index
<b>COLD</b>	use designation for cold water aquatic life	<b>SMI</b>	DEQ's Stream Macroinvertebrate Index
<b>DEQ</b>	Idaho Department of Environmental Quality	<b>SS</b>	salmonid spawning
<b>DO</b>	dissolved oxygen	<b>SWPPP</b>	stormwater pollution prevention plan
<b>DWS</b>	domestic water supply	<b>TKN</b>	total Kjeldahl nitrogen
<b>EPA</b>	United States Environmental Protection Agency	<b>TMDL</b>	total maximum daily load
<b>IDAPA</b>	refers to citations of Idaho administrative rules	<b>TN</b>	total nitrogen
<b>IDL</b>	Idaho Department of Lands	<b>TP</b>	total phosphorus
<b>LA</b>	load allocation	<b>TSS</b>	total suspended solids
<b>LC</b>	load capacity	<b>US</b>	United States
<b>mg/L</b>	milligrams per liter	<b>USFS</b>	United States Forest Service
<b>mL</b>	milliliter	<b>WAG</b>	watershed advisory group
		<b>WBAG</b>	<i>Water Body Assessment Guidance</i>
		<b>WLA</b>	wasteload allocation

## Executive Summary

The federal Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards).

States and tribes must periodically publish a priority list (a “§303(d) list”) of impaired waters. Currently, this list is published every 2 years as the list of Category 5 water bodies in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses 4 water bodies (6 assessment units) in the Curlew Valley subbasin that have been placed in Category 5 of Idaho's 2014 federally approved Integrated Report (DEQ 2017).

This addendum describes the key physical and biological characteristics of the subbasin; water quality concerns and status; pollutant sources; and recent pollution control actions in the Curlew Valley subbasin, located in southeast Idaho.

The TMDL analysis establishes water quality targets and load capacities, estimates existing pollutant loads, and allocates responsibility for load reductions needed to return listed waters to a condition meeting water quality standards. It also identifies implementation strategies—including reasonable time frames, approach, responsible parties, and monitoring strategies—necessary to achieve load reductions and meet water quality standards.

The Curlew Valley subbasin is a Great Basin drainage located in southeast Idaho and northern Utah. In Idaho, this subbasin has poor water quality. All Beneficial Use Reconnaissance Program (BURP) surveys indicate cold water aquatic life is not supported. In the 2014 Integrated Report (DEQ 2017), all assessment units (AUs) are either impaired (on the §303(d) list) or unassessed. Streams are primarily impaired by sedimentation/siltation, *Escherichia coli* (*E. coli*) bacteria, and flow alterations.

This document establishes TMDLs for the following 4 AUs:

- ID16020309BR001\_03–North Canyon
- ID16020309BR002\_02a–Sheep Creek
- ID16020309BR003\_02a–Meadow Brook Creek
- ID16020309BR003\_03a–Rock Creek (Curlew Valley)

TMDLs were set using target concentrations for total suspended solids (TSS) and *E. coli* bacteria at levels to restore support of beneficial uses (cold water aquatic life and secondary contact recreation). Targets for TSS varied seasonally. High flow (March–June) targets for TSS were set as a seasonal average of 52 mg/L (turbidity of 24 nephelometric turbidity units [NTUs] can be used as a surrogate measurement). Low flow (July–February) targets for TSS were set at a seasonal average of 25 mg/L TSS (turbidity of 10 NTUs can be used as a surrogate measurement).

TMDLs for *E. coli* were set at Idaho's water quality standard of a geometric mean of less than 126 organisms/100 milliliters (mL) calculated from at least five samples collected every 3–7 days over 30 days. These TMDLs apply to ID16020309BR002\_02a–Sheep Creek, ID16020309BR003\_02a–Meadow Brook Creek, and ID16020309BR003\_03a–Rock Creek.

## **Subbasin at a Glance**

The Curlew Valley subbasin is located in southeast Idaho and northern Utah (Figure A). Streams located in the Idaho portion of the drainage flow out of the North Hansel Mountains and the Black Pine Mountains that bound the Curlew Valley and south into Utah. The Curlew Valley is part of the South-East Basin and Range geologic province of Idaho and is underlain mainly by Paleozoic sediments. The Curlew Valley drains to the Great Salt Lake and was mostly inundated by Lake Bonneville until 14,500 years ago when the lake breached a natural, earthen dam at Red Rock Pass causing the Bonneville Flood. The lake then drained to the Provo level leaving much of the Curlew Valley underwater until climatic changes caused the Great Salt Lake to retreat to its current levels, removing the lake conditions in the Curlew Valley.

Deep Creek is the main waterway in the subbasin of which Rock Creek is the major tributary (although they are often hydrologically disconnected). Deep Creek is impounded by Stone Reservoir where much of its flow is diverted for irrigation during summer months. Public lands account for 65.7% of the subbasin. The Bureau of Land Management (BLM) manages 46.5% of the subbasin, of which 15% were acquired by the federal government under the 1937 Bankhead-Jones Farm Tenant Act. This legislation authorized the federal government to acquire damaged lands to rehabilitate and use. The United States Forest Service (USFS) manages another 17.5% of the subbasin, 9.9% of which is grassland. The Idaho Department of Lands manages 1.8% of the subbasin, and private landownership accounts for 34.3%. Economic activities in the subbasin include livestock grazing, agriculture, and recreation.

The Curlew Valley subbasin in Idaho is mainly contained in Oneida County with a small portion of the northern basin encompassed by Power County. A portion of the western basin is within Cassia County. The subbasin is sparsely populated, contains no cities, and has only two unincorporated communities, Holbrook and Stone.

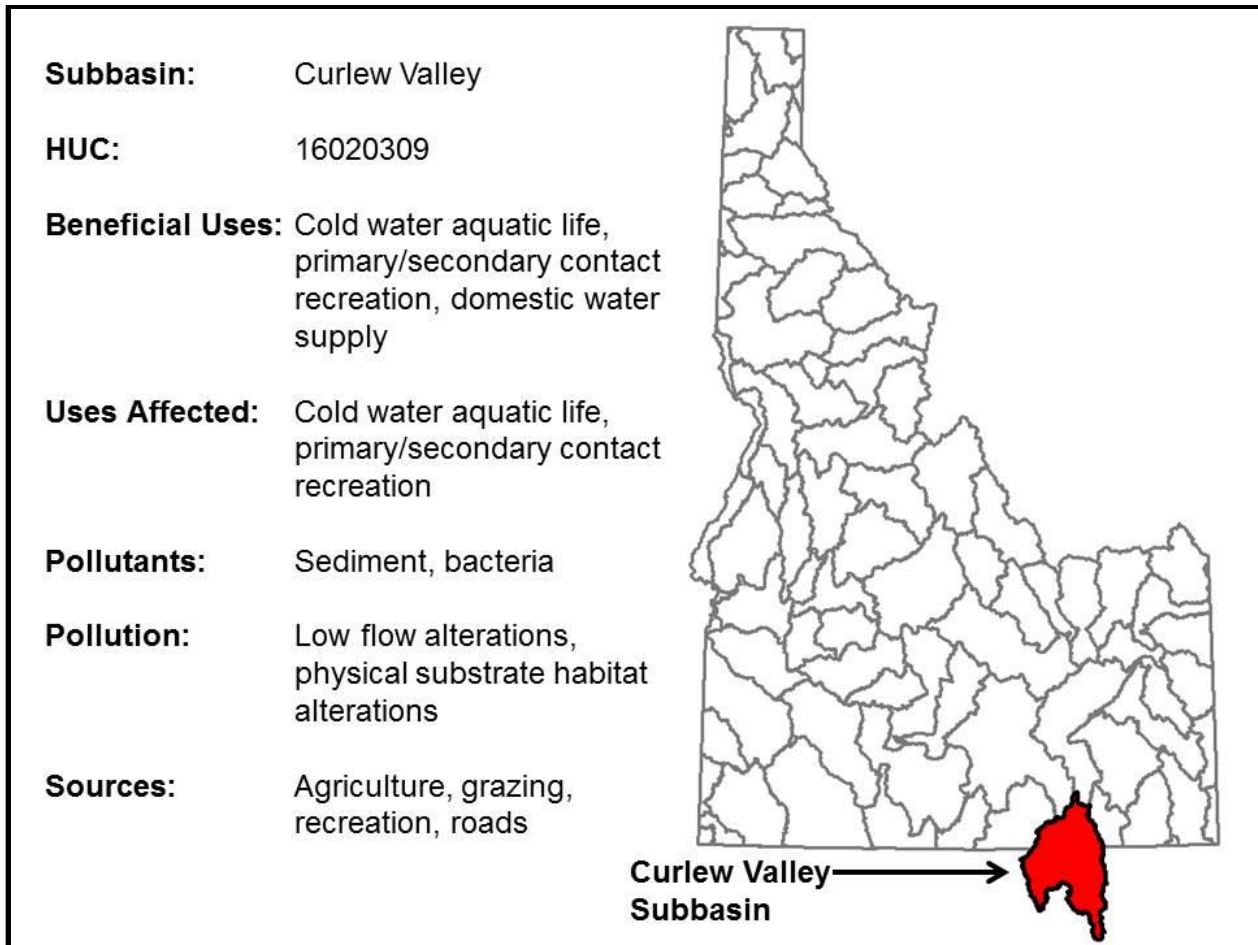
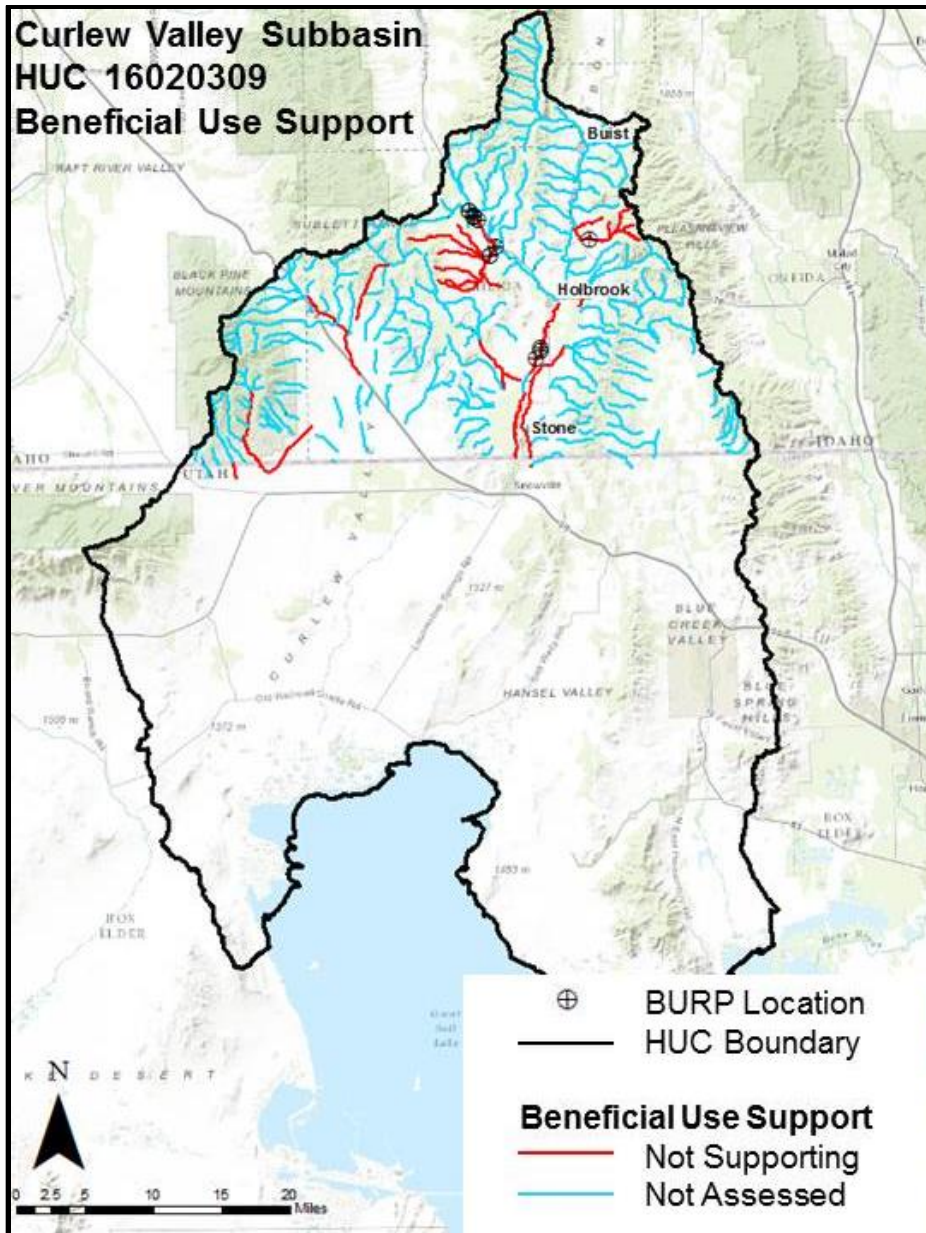


Figure A. Curlew Valley subbasin.

## Key Findings

Historically, Curlew Valley water bodies likely supported several beneficial uses. All streams presumably supported cold water aquatic life, agricultural water supply, and secondary contact recreation. Some streams also supported domestic water supply. In the 2014 Integrated Report, 6 AUs were on the §303(d) list as not supporting beneficial uses and in need of a TMDL. The remaining 6 AUs were listed in Category 3 as unassessed. No AUs in the subbasin are currently known to be supporting beneficial uses in the Integrated Report (Figure B).



**Figure B. The 2014 Integrated Report beneficial use support status and BURP locations.**

DEQ conducted water quality sampling in the Curlew Valley subbasin in 2016 and 2017 to estimate current pollutant loads. Results from North Canyon, Sheep Creek, Meadow Brook Creek, and Rock Creek indicated excess loads of TSS. *E. coli* loads in excess of water quality standards were documented at Sheep Creek, Meadow Brook Creek, and Rock Creek. TMDLs were developed for these pollutants (Table A).

**Table A. Water bodies and pollutants for which TMDLs were developed.**

Water Body	AU Number	Pollutants
North Canyon	ID16020309BR001_03	TSS
Sheep Creek	ID16020309BR002_02a	TSS, <i>E. coli</i>
Meadow Brook Creek	ID16020309BR003_02a	TSS, <i>E. coli</i>
Rock Creek	ID16020309BR003_03a	TSS, <i>E. coli</i>

TMDLs were set using target concentrations (Table B) and measured flow. Targets were set to restore beneficial use support. TSS targets were seasonal because sediment loads are naturally higher during runoff conditions than during low flow conditions. Low flow months are July–February, and high flow months are March–June. TSS is strongly correlated with turbidity, so turbidity can be measured to track TMDL compliance and implementation.

*E. coli* targets reflect water quality standards.

**Table B. Curlew Valley pollutant targets.**

Pollutant	Target	Associated Turbidity Target	Applies to
Total suspended solids	25 mg/L (July - February seasonal average)	10 NTU	ID16020309BR001_03
	52 mg/L (March – June seasonal average)	24 NTU	ID16020309BR002_02a
			ID16020309BR003_02a
			ID16020309BR003_03a
<i>Escherichia coli</i>	126 organisms/100 mL	n/a	ID16020309BR002_02a ID16020309BR003_02a ID16020309BR003_03a

Water quality sampling at Deep Creek (ID16020309BR001\_03a) did not indicate excess sediment loading. Deep Creek is a spring-fed stream, and BURP metrics were not developed to measure support of cold water aquatic life in spring stream systems. This stream has a highly modified flow regime. It is heavily diverted and impounded by Stone Reservoir. It should be listed for low flow alterations in Category 4c in the next Integrated Report and removed from Category 5 for sedimentation/siltation.

Table C summarizes the assessment outcomes for §303(d)-listed streams in the Curlew Valley subbasin. TMDLs were developed for 4 AUs that should be removed from the §303(d) list (Category 5) in the next Integrated Report.

**Table C. Summary of assessment outcomes for §303(d)-listed assessment units.**

AU Name	AU Number	Pollutants	Pollution	TMDLs Completed	Recommended Changes to Next Integrated Report	Justification
North Canyon	ID16020309BR001_03	Sedimentation/siltation	Low flow alterations	TSS	Move from Category 5 for sedimentation/siltation to Category 4a for TSS. Split North Canyon from the rest of the AU and name the remaining portion ID16020309BR001_03b. Place ID16020309BR001_03b in Category 3 as unassessed.	TMDLs completed for TSS for North Canyon. ID16020309BR001_03b is intermittent and has never been surveyed by BURP.
Deep Creek	ID16020309BR001_03a	Sedimentation/siltation	Low flow alterations	None	Move from Category 5 for sedimentation/siltation to Category 4c for Low flow alterations.	Water quality monitoring indicates sedimentation/siltation is not impacting this AU. This AU is impounded by a reservoir and is heavily diverted for irrigation. AU is spring-fed and should not be assessed using BURP protocols.
Sheep Creek	ID16020309BR002_02a	Fecal coliform, sedimentation/siltation	Physical substrate habitat alterations	TSS, <i>E. coli</i>	Move from Category 5 for fecal coliform and sedimentation/siltation to Category 4a for TSS and <i>E. coli</i> .	TMDLs completed for TSS and <i>E. coli</i> .
Rock Creek—source to mouth	ID16020309BR003_02	Combined biota/habitat bioassessments	n/a	None	None	Not assessed until 2017, so not included in sampling.
Meadow Brook Creek	ID16020309BR003_02a	<i>E. coli</i> , sedimentation/siltation	Physical substrate habitat alterations	TSS, <i>E. coli</i>	Move from Category 5 for <i>E. coli</i> and sedimentation/siltation to Category 4a for TSS and <i>E. coli</i> .	TMDLs completed for TSS, and <i>E. coli</i> .
Rock Creek (Curlew Valley)	ID16020309BR003_03a	Sedimentation/siltation, <i>E. coli</i>	Physical substrate habitat alterations	TSS, <i>E. coli</i>	Move from Category 5 for sedimentation/siltation and <i>E. coli</i> to Category 4a for TSS and <i>E. coli</i> .	TMDLs completed for TSS and <i>E. coli</i> .

## **Public Participation**

A draft of this document was presented to the Board of the Oneida Soil and Water Conservation District at their monthly meeting on March 14, 2018. The same draft was sent to USFS and BLM staff on March 14, 2018 to allow them to comment on the document prior to the formal public comment period. The public comment period for this document was open from May 10, 2018 to June 11, 2018. Comments were solicited by ads run in the Idaho State Journal and the Idaho Enterprise. No comments were received. DEQ submitted the Curlew Valley Subbasin Assessment and TMDL to EPA on November 29, 2018. DEQ received comments for EPA on the TMDL submittal on February 25, 2019. This document addresses comments from EPA.

# 1 Introduction

This document addresses six water bodies in the Curlew Valley subbasin that have been placed in Category 5 of Idaho’s most recent federally approved Integrated Report (DEQ 2017). The purpose of this total maximum daily load (TMDL) is to characterize and document pollutant loads within the Curlew Valley subbasin. The first portion of this document presents key characteristics or updated information for the subbasin assessment, which is divided into four major sections: subbasin characterization (section 1), water quality concerns and status (section 2), pollutant source inventory (section 3), and a summary of past and present pollution control efforts (section 4). While the subbasin assessment is not a requirement of the TMDL, the Idaho Department of Environmental Quality (DEQ) performs the assessment to ensure impairment listings are up to date and accurate.

The subbasin assessment is used to develop a TMDL for each pollutant of concern for the Curlew Valley subbasin. The TMDL (section 6) is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

## 1.1 Regulatory Requirements

This document was prepared in compliance with both federal and state regulatory requirements. The federal government, through the United States Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. DEQ implements the Clean Water Act in Idaho, while EPA oversees Idaho and certifies the fulfillment of Clean Water Act requirements and responsibilities.

Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act (CWA), in 1972. The goal of this act was to “restore and maintain the chemical, physical, and biological integrity of the Nation’s waters” (33 USC §1251). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The CWA has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to ensure “swimmable and fishable” conditions. These goals relate water quality to more than just chemistry.

The CWA requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation’s waters. States and tribes, pursuant to Section 303 of the CWA, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation’s waters whenever possible. DEQ must review those standards every 3 years, and EPA must approve Idaho’s water quality standards. Idaho adopts water quality standards to protect public health and welfare, enhance water quality, and protect biological integrity. A water quality standard defines the goals of a water body by

designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a “§303(d) list”) of impaired waters. Currently, this list is published every 2 years as the list of Category 5 waters in Idaho’s Integrated Report. For waters identified on this list, states and tribes must develop a TMDL for the pollutants, set at a level to achieve water quality standards.

DEQ monitors surface waters of the state, and for those not meeting water quality standards, DEQ must establish a TMDL for each pollutant impairing the waters. However, some conditions that impair water quality do not require TMDLs. EPA considers certain unnatural conditions—such as flow alteration, human-caused lack of flow, or habitat alteration—that are not the result of discharging a specific pollutant as “pollution.” TMDLs are not required for water bodies impaired by pollution, rather than a specific pollutant. A TMDL is only required when a pollutant can be identified and in some way quantified.

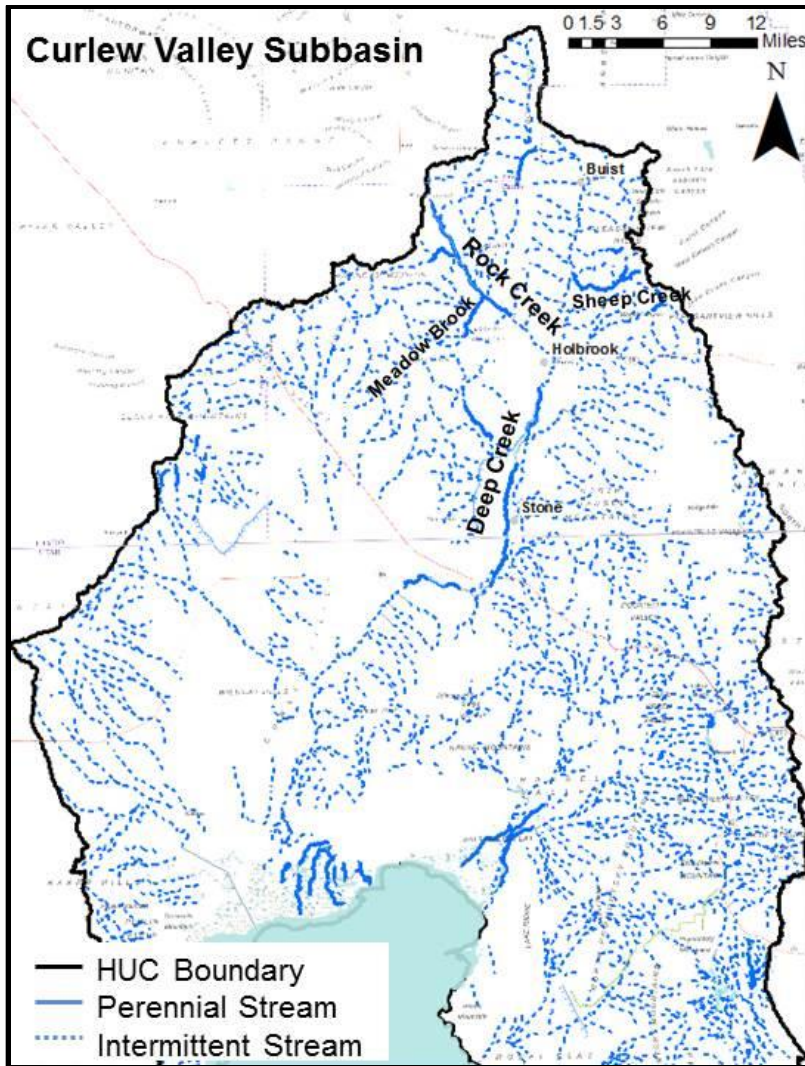
## **2 Subbasin Assessment—Subbasin Characterization**

The Curlew Valley subbasin is located in southeast Idaho and northern Utah. Streams located in the Idaho portion of the drainage flow out of the North Hansel Mountains and the Black Pine Mountains that bound the Curlew Valley and south into Utah (Figure 1). The Curlew Valley is part of the South-East Basin and Range geologic province of Idaho and is underlain mainly by Paleozoic sediments. The Curlew Valley drains to the Great Salt Lake and was mostly inundated by Lake Bonneville until 14,500 years ago when the lake undermined a natural, earthen dam at Red Rock Pass causing the Bonneville Flood. The lake then drained to the Provo level leaving much of the Curlew Valley underwater until climactic changes caused the Great Salt Lake to retreat to its current levels.

In Idaho, the Curlew Valley subbasin is mainly contained in Oneida County with a small portion of the northern basin encompassed by Power County. A portion of the western basin is within Cassia County. The subbasin is sparsely populated, contains no cities, and has only two unincorporated communities, Holbrook and Stone.

Elevations in the subbasin range from nearly 9,300 feet at the divide on the western edge of the basin in the Black Pine Mountains to 4,500 feet as Deep Creek exits Idaho into Utah. Precipitation in the subbasin ranges from 12 to 27 inches annually, and the climate is characterized by hot, dry summers and cold winters.

Level IV ecoregions in the subbasin include high elevation forest and shrublands at the mountain tops, semiarid hills and low mountains, sagebrush steppe valleys, and shadscale saltbush-dominated saline basins in the southern portion of the basin. Vegetation cover is primarily Great Basin pinyon-juniper woodland, intermountain basin big sagebrush shrubland, pasture/hay fields, cultivated crops, irrigated agriculture, and general agriculture.



**Figure 1. Perennial and intermittent streams in the Curlew Valley subbasin.**

Deep Creek is the main waterway in the subbasin of which Rock Creek is the major tributary. Deep Creek is impounded by Stone Reservoir where much of its flow is diverted for irrigation during summer months. Public lands account for 65.7% of the subbasin. The Bureau of Land Management (BLM) manages 46.5% of the subbasin of which 15% of the lands that were acquired by the federal government under the 1937 Bankhead-Jones Farm Tenant Act. This legislation authorized the federal government to acquire, rehabilitate, and use damaged lands. The United States Forest Service (USFS) manages another 17.5% of the subbasin, 9.9% of which is grassland. The Idaho Department of Lands (IDL) manages 1.8% of the subbasin, and private landownership accounts for 34.3% (Figure 2). Economic activities in the subbasin include livestock grazing, agriculture, and recreation.

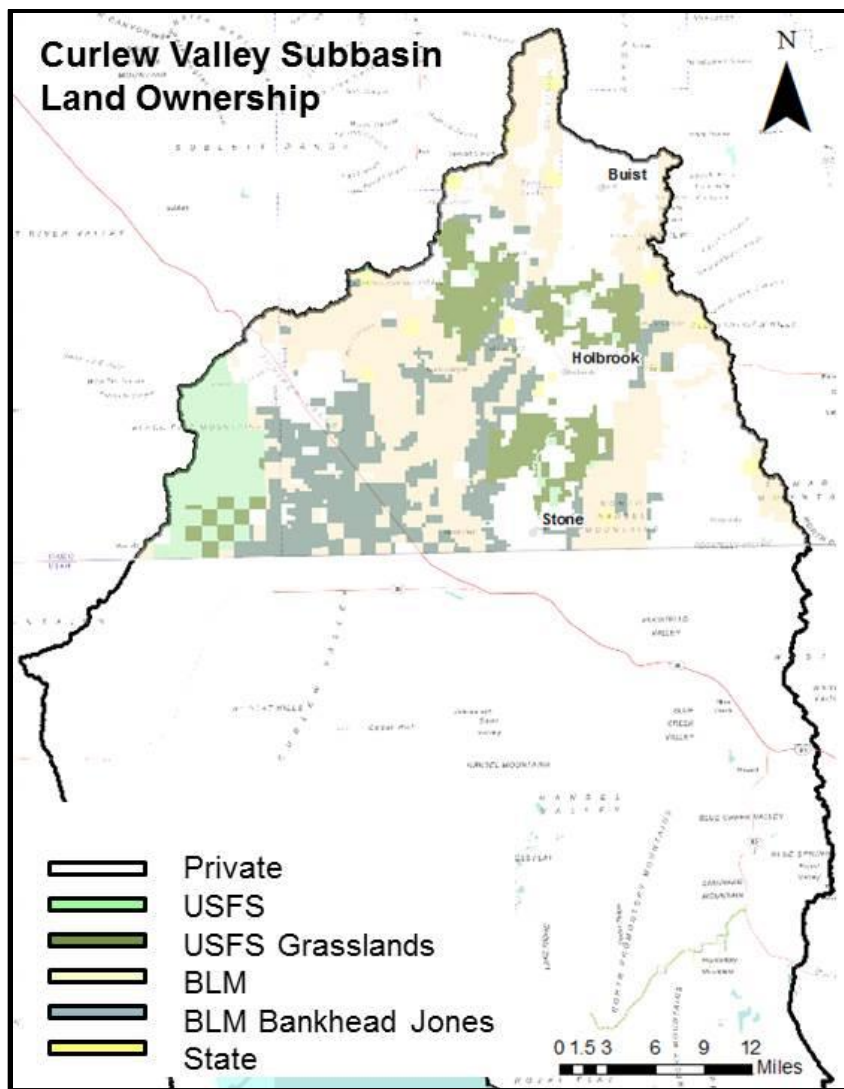


Figure 2. Landownership in the Curlew Valley subbasin.

### 3 Subbasin Assessment—Water Quality Concerns and Status

This section covers the water quality limited segments occurring in the subbasin, applicable water quality standards and beneficial uses, and a summary and analysis of existing water quality data.

#### 3.1 Water Quality Limited Assessment Units Occurring in the Subbasin

Section 303(d) of the CWA states that waters that are unable to support their beneficial uses and do not meet water quality standards must be listed as water quality limited. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with water quality standards.

### 3.1.1 Assessment Units

Assessment units (AUs) are groups of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs—even if ownership and land use change significantly, the AU usually remains the same for the same stream order.

Using AUs to describe water bodies offers many benefits primarily that all waters of the state are defined consistently. AUs are a subset of water body identification numbers, which allows them to relate directly to the water quality standards.

### 3.1.2 Listed Waters

Table 1 shows the pollutants listed and the basis for listing for each §303(d)-listed AU in the subbasin (i.e., AUs in Category 5 of the Integrated Report).

**Table 1. Curlew Valley §303(d)-listed assessment units in the subbasin.**

AU Name	AU Number	Listed Pollutants	First Listing
North Canyon	ID16020309BR001_03	Sedimentation/siltation	2008 Integrated Report
Deep Creek	ID16020309BR001_03a	Sedimentation/siltation	2008 Integrated Report
Sheep Creek	ID16020309BR002_02a	Sedimentation/siltation, fecal coliform	2002 Integrated Report
Rock Creek—source to mouth	ID16020309BR003_02	Combined biota/habitat bioassessments	2014 Integrated Report
Meadow Brook Creek	ID16020309BR003_02a	<i>E. coli</i> , sedimentation/siltation	2002 Integrated Report
Rock Creek (Curlew Valley)	ID16020309BR003_03a	<i>E. coli</i> , sedimentation/siltation	2002 Integrated Report

Note: *Escherichia coli* (*E. coli*)

## 3.2 Applicable Water Quality Standards and Beneficial Uses

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses and are described in more detail at [www.deq.idaho.gov/water-quality/surface-water/beneficial-uses](http://www.deq.idaho.gov/water-quality/surface-water/beneficial-uses) and in Appendix A. The *Water Body Assessment Guidance* (DEQ 2016a) provides a more detailed description of beneficial use identification for use assessment purposes.

Beneficial uses include the following:

Aquatic life support—cold water, seasonal cold water, warm water, salmonid spawning, and modified

- Contact recreation—primary (swimming) or secondary (boating)
- Water supply—domestic, agricultural, and industrial
- Wildlife habitats
- Aesthetics

### 3.2.1 Beneficial Uses in the Subbasin

The Curlew Valley subbasin contains AUs with both designated and presumed beneficial uses (Table 2). Deep Creek is designated in Idaho’s water quality standards for cold water aquatic life, primary contact recreation, and domestic water supply. It is assumed that other streams in the Curlew Valley subbasin support cold water aquatic life and secondary contact recreation, with ID16020309BR003\_03a also presumed to support salmonid spawning.

**Table 2. Curlew Valley subbasin beneficial uses of §303(d)-listed streams.**

AU Name	AU Number	Beneficial Uses	Type of Use
North Canyon	ID16020309BR001_03	COLD, PCR, DWS	Designated
Deep Creek	ID16020309BR001_03a	COLD, PCR, DWS	Designated
Sheep Creek	ID16020309BR002_02a	COLD, SCR	Presumed
Rock Creek—source to mouth	ID16020309BR003_02	COLD, SCR	Presumed
Meadow Brook Creek	ID16020309BR003_02a	COLD, SCR	Presumed
Rock Creek (Curlew Valley)	ID16020309BR003_03a	COLD, SS, SCR	Presumed

a. Cold water aquatic life (COLD), primary contact recreation (PCR), secondary contact recreation (SCR), domestic water supply (DWS), salmonid spawning (SS)

### 3.2.2 Water Quality Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of water quality criteria, which include *numeric* criteria for pollutants such as bacteria, DO, pH, ammonia, temperature, and turbidity (see Appendix B), and *narrative* criteria for pollutants such as sediment and nutrients (IDAPA 58.01.02.250–251).

Narrative criteria for excess sediment are described in the water quality standards:

Sediment shall not exceed quantities specified in Sections 250 and 252, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350. (IDAPA 58.01.02.200.08)

DEQ’s procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.050.02. The procedure relies heavily upon biological parameters and is presented in detail in the *Water Body Assessment Guidance* (DEQ 2016a). This guidance requires DEQ to use the most complete data available to make beneficial use support status determinations.

### **3.3 Summary and Analysis of Existing Water Quality Data**

Most data used to generate TMDL and listing recommendations originated from DEQ Beneficial Use Reconnaissance Program (BURP) surveys conducted in the subbasin from 1996 to 2015 (Table 3). BURP collects data on AUs to determine support status of beneficial uses in basins throughout the state. BURP data evaluations are based on three facets of the ecology of wadeable streams: macroinvertebrates, habitat, and fish. Individual metrics within each category are used to generate multimetric index scores. These scores consist of the stream macroinvertebrate index (SMI), stream habitat index (SHI), and stream fish index (SFI). From those scores, condition rankings of 0, 1, 2, or 3 are assigned to sites based on percentile categories of reference conditions. At least two scores are needed to evaluate a stream's support status; those scores must average 2 or greater for beneficial uses to be considered supported.

In the Curlew Valley subbasin, no BURP surveys resulted in condition ratings indicating support of cold water aquatic life (Table 3). In most surveys, at least one index score was 0, indicating that score was below the minimum threshold of reference conditions. BURP data indicate beneficial uses in the Curlew Valley subbasin are not being supported.

**Table 3. BURP scores (1996–2015) for AUs in the Curlew Valley subbasin.**

AU Name	AU Number	BURP ID	SMI Score	SMI Rating	SFI Score	SFI Rating	SHI Score	SHI Rating	Average
Deep Creek	ID16020309BR001_03a	1996SPOCA012	21.37	0	—	—	40	1	0
		2002SPOCA022	32.01	0	35.6	0	45	1	0
		2014SPOCA026 <sup>a</sup>	62	2	44	1	61	2	1.67
Sheep Creek	ID16020309BR002_02a	1998SPOCA046	14.93	0	—	—	18	1	0
Rock Creek—source to mouth	ID16020309BR003_02	2011SPOCA064	38.99	1	37.01	0	47	1	0
		2015SPOCA019 <sup>a</sup>	48	1	—	—	54	2	1.5
Meadow Brook Creek	ID16020309BR003_02a	1998SPOCA045	19.89	0	—	—	19	1	0
		2003SPOCA018	23.68	0	—	—	24	1	0
Rock Creek (Curlew Valley)	ID16020309BR003_03a	1998SPOCA044	28.14	0	—	—	54	2	0
		2003SPOCA017	33.13	1	—	—	37	1	1
		2004SPOCA017	30.5	0	—	—	50	2	0
		2014SPOCA025 <sup>1</sup>	62	2	58	1	30	1	1.33

a. SMI2, SFI2, and SHI2 scores reported

Another aspect of the BURP program is sampling water for *Escherichia coli* (*E. coli*) bacteria to assess the support status of recreational beneficial uses. Bacteria data have been collected in the Curlew Valley subbasin from 1999 to 2016 (Table 4). Results indicate that Deep Creek (ID16020309BR001\_03a) is supporting its recreational beneficial use. For Sheep Creek (ID16020309BR002\_02a), Meadow Brook Creek (ID16020309BR003\_02a), Rock Creek and South Fork Rock Creek (ID16020309BR003\_03a), *E. coli* results indicate recreational beneficial use is not supported.

**Table 4. *E. coli* data for AUs in the Curlew Valley subbasin (1999-2016)**

<b>AU Name</b>	<b>AU Number</b>	<b>Sample Location</b>	<b>Collection Date and <i>E. coli</i> Concentration (organisms/100 mL)</b>					<b><i>E. coli</i> geometric mean (organisms/100 mL)</b>
Deep Creek	ID16020309BR001_03a	—  42.10526, -111.67487	9/1/1999 40  8/13/2014 186	—  —  —  —	—  —  —  —	—  —  —  —	—  —  —  —	—  —  —  —
Sheep Creek	ID16020309BR002_02a	Off USFS Rd 006 42.23086, -112.594844 42.23722, -112.56070	9/1/1999 1,800 7/6/2016 >2,419	9/14/1999 5,800 7/11/2016 >2,419	9/20/1999 1,050 7/18/2016 920.8	9/22/1999 2,000 7/25/2016 >2,419	9/23/1999 960 8/1/2016 >2,419	<b>1,839<sup>a</sup></b>  <b>1,994</b>
Meadow Brook Creek	ID16020309BR003_02a	42.22353, -112.72974  At Juniper Rd. crossing  42.22353, -112.72974	9/1/1999 90 8/25/2003 580 8/11/2015 138	—  8/28/2003 370 8/14/2015 270	—  9/2/2003 490 8/18/2015 436	—  9/8/2003 70 8/24/2015 238	—  9/15/2003 58 8/28/2015 457	—  <b>212</b>  <b>281</b>
Rock Creek (Curlew Valley)	ID16020309BR003_03a	Off HWY 38 42.257524, -111.760713	9/1/1999 10	—  —  —  —	—  —  —  —	—  —  —  —	—  —  —  —	—  —  —  —
South Fork Rock Creek	ID16020309BR003_03a	1/4 mile downstream of BURP site (2003SPOCA017)  42.22402, -112.73019	8/25/2003 490 8/7/2014 2,420	—  8/13/2014 687	—  8/18/2014 2,420	—  8/21/2014 14,500	—  8/25/2014 1,733	—  <b>2,517</b>

Note: milliliter (mL)

a. Sampling did not conform to current procedure of 5 samples taken 3 to 7 days apart.

In 2016 and 2017, DEQ conducted water quality sampling to identify impairments and quantify pollutant loads in the Curlew Valley. During sampling events, field parameters were collected with a YellowSpring Instruments model 6920 multiparameter sonde (containing probes for measurements of temperature, specific conductivity, DO, pH, and turbidity). Additionally, water samples were collected for laboratory analysis of total suspended solids (TSS, also described as suspended sediment throughout this document), total phosphorus (TP), nitrate, total Kjeldahl nitrogen (TKN), and total nitrate (TN).

**Table 5. Water quality results from §303(d)-listed assessment units in the Curlew Valley subbasin.**

Site	AU <sup>a</sup>	Date	Flow (cfs)	Field Parameters						Laboratory Parameters				
				Temp (°C)	Spec. Cond (ms/cm <sup>2</sup> )	DO (%)	DO (mg/L)	pH	Turbidity (NTU)	TSS (mg/L)	TP (mg/L)	Nitrate (mg/L)	TKN (mg/L)	TN (mg/L)
North Canyon	BR001_03	07/07/2016	—	17.13	0.802	79.8	7.67	7.92	22.9	40	0.088	0.52	0.54	1.06
		03/23/2017	0.1	7.67	0.820	81.3	9.68	8.07	6.5	8	0.053	0.92	0.22	1.14
		05/10/2017	0.1	14.96	0.794	81.6	8.20	8.20	11.0	11	0.045	0.42	0.28	0.70
		06/14/2017	—	13.99	0.794	79.2	8.15	8.14	13.9	38	0.069	0.43	0.36	0.79
		07/17/2017	—	17.48	0.814	79.4	7.57	7.96	31.6	380	0.220	0.99	0.99	1.98
Deep Creek above Stone Reservoir	BR001_03a	07/07/2016	29.9	19.70	0.773	64.5	5.88	7.34	0.0	<5	0.008	0.29	<0.10	0.29
		03/23/2017	29.1	18.76	0.784	80.5	7.49	7.75	1.5	<5	0.015	0.35	<0.10	0.35
		05/10/2017	23.8	19.98	0.768	88.8	8.06	7.84	0.0	<5	0.010	0.26	0.20	0.46
		06/14/2017	28.9	19.78	0.773	64.3	5.86	7.73	0.0	<5	0.010	0.30	<0.10	0.30
		07/17/2017	30.5	20.04	0.777	76.9	6.97	7.57	2.0	8	0.012	0.26	0.12	0.38
Deep Creek below Stone Reservoir	BR001_03a	07/07/2016	7.9	25.23	0.801	143.8	11.82	8.45	9.5	14	0.054	0.022	0.37	0.39
		03/23/2017	4.4	9.67	0.879	102.7	11.67	8.05	10.2	16	0.085	0.31	0.53	0.84
		05/10/2017	11.2	18.19	0.804	120.6	11.36	8.49	7.1	13	0.043	0.12	0.34	0.46
		06/14/2017	9.5	20.79	0.837	128.4	11.46	8.51	3.6	<5	0.044	0.14	0.28	0.42
		07/17/2017	5.2	24.18	0.842	142.3	11.91	8.28	3.7	<5	0.037	0.072	0.3	0.37
Sheep Creek	BR002_02a	07/06/2016	—	23.57	0.562	68.9	5.65	8.10	331.5	670	1.400	0.22	5.00	5.22
		03/23/2017	4.1	5.29	0.466	80.1	10.13	8.18	54.0	110	0.290	1.80	0.74	2.54
		05/10/2017	1.3	13.27	0.516	90.9	9.50	8.71	5.8	11	0.067	0.18	0.33	0.51
		06/14/2017	0.5	16.24	0.547	90.1	8.82	8.57	8.8	14	0.062	<0.01	0.36	0.36
		07/17/2017	0.1	19.50	0.568	90.4	8.28	8.39	9.1	8	0.055	<0.01	0.26	0.26
Meadow Brook Creek	BR003_02a	07/06/2016	—	21.68	1.294	107.8	9.45	7.82	20.1	100	0.430	<0.01	2.00	2.00
		03/23/2017	1.2	6.61	1.536	80.7	9.84	8.17	2.0	<5	0.089	<0.01	0.41	0.41
		05/10/2017	0.4	17.23	1.442	91.9	8.79	8.24	11.5	22	0.120	<0.01	0.55	0.55
		06/14/2017	0.3	15.99	1.401	80.5	7.91	8.18	15.7	32	0.100	<0.01	0.53	0.53
		07/17/2017	0.04	25.11	1.233	67.2	5.52	7.76	16.2	21	0.560	<0.01	2.30	2.30
Lower Rock Creek	BR003_03a	07/06/2016	1.2	20.38	0.801	94.7	8.53	8.34	5.6	6	0.072	<0.01	0.25	0.25
		03/23/2017	2.9	6.21	0.947	80.8	9.98	8.10	134.0	330	0.570	1.40	1.60	3.00
		05/10/2017	1.8	13.89	0.897	92.5	9.53	8.40	43.9	110	0.210	0.93	0.64	1.57
		06/14/2017	1.7	15.53	0.852	89.2	8.86	8.33	46.2	120	0.210	0.75	0.49	1.24

Site	AU <sup>a</sup>	Date	Flow (cfs)	Field Parameters						Laboratory Parameters				
				Temp (°C)	Spec. Cond (ms/cm <sup>2</sup> )	DO (%)	DO (mg/L)	pH	Turbidity (NTU)	TSS (mg/L)	TP (mg/L)	Nitrate (mg/L)	TKN (mg/L)	TN (mg/L)
		07/17/2017	1.1	18.16	0.818	92.6	8.72	8.12	52.9	110	0.260	0.82	0.70	1.52
Upper Rock Creek	BR003_03a	07/06/2016	0.7	16.37	0.772	77.8	7.60	7.88	2.5	8	0.059	<0.01	0.23	0.23

Notes: cubic feet per second (cfs), degrees Celsius (°C), dissolved oxygen (DO), milligrams per liter (mg/L), millisecond per square centimeter (ms/cm<sup>2</sup>), nephelometric turbidity unit (NTU), total Kjeldahl nitrogen (TKN), total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS)

— Indicates parameter was not measured.

a. All AU numbers begin with ID16020309.

### **3.3.1 Status of Beneficial Uses**

Sediment, bacteria, habitat modifications, and flow alterations are stressors affecting beneficial uses in this subbasin. Much of the basin is grazed on public and private lands. Livestock typically have direct access to the stream channel, and off-channel watering facilities are not available. Grazing can impact streams by destabilizing banks, reducing riparian vegetation, spreading invasive species, and widening the stream channel (Belsky et al. 1999). Livestock grazing can also impact the beneficial use of contact recreation by increasing bacteria concentrations in streams. Agricultural practices can impact streams by increasing erosion and contributing excess sediment to streams. Bacteria concentrations may increase in streams bordered by fields where manure is applied. Streams are often physically straightened along or within fields to increase the acreage of land that can be under cultivation. Agriculture also can impact water bodies through irrigation diversions. If a stream is totally dewatered, it cannot support its beneficial uses.

### **3.3.2 Assessment Unit Summary**

A summary of the data analysis, literature review, and field investigations and a list of conclusions for AUs included in Category 5 of the 2014 Integrated Report follows. This section includes changes that will be documented in the next Integrated Report once the TMDLs in this document have been approved by EPA.

**ID16020309BR001\_03, Deep Creek—Rock Creek to Idaho/Utah border (Figure 3)**

- On §303(d) list for sedimentation/siltation. Listed in Category 4c for low flow alterations.
- Never surveyed by BURP.
- North Canyon (a portion of this AU) is a spring-fed stream that is heavily diverted at its source for stock watering, resulting in very low flows.
- Watershed is primarily used for cattle grazing on public and private land.
- Water quality monitoring in North Canyon indicates that suspended sediment is often high during low flow periods.
- TMDLs were developed for TSS based on sampling results from North Canyon.
- Split North Canyon from the remaining portion of the AU and label as ID16020309BR001\_03. The remaining, intermittent portion of the AU should be labeled ID16020309BR001\_03b. Proposed split displayed in Figure 4.
- Move sedimentation/siltation from Category 5 to Category 4a for TSS.
- The remaining portion of the AU, Deep Creek—Rock Creek to Idaho/Utah border (ID16020309BR001\_03b), is intermittent, has never been monitored for water quality, and is unable to be surveyed by BURP. Place this AU in Category 3 as unassessed in future Integrated Reports.



**Figure 3. North Canyon (ID16020309BR001\_03) on BLM land (left) and downstream on private land (right).**

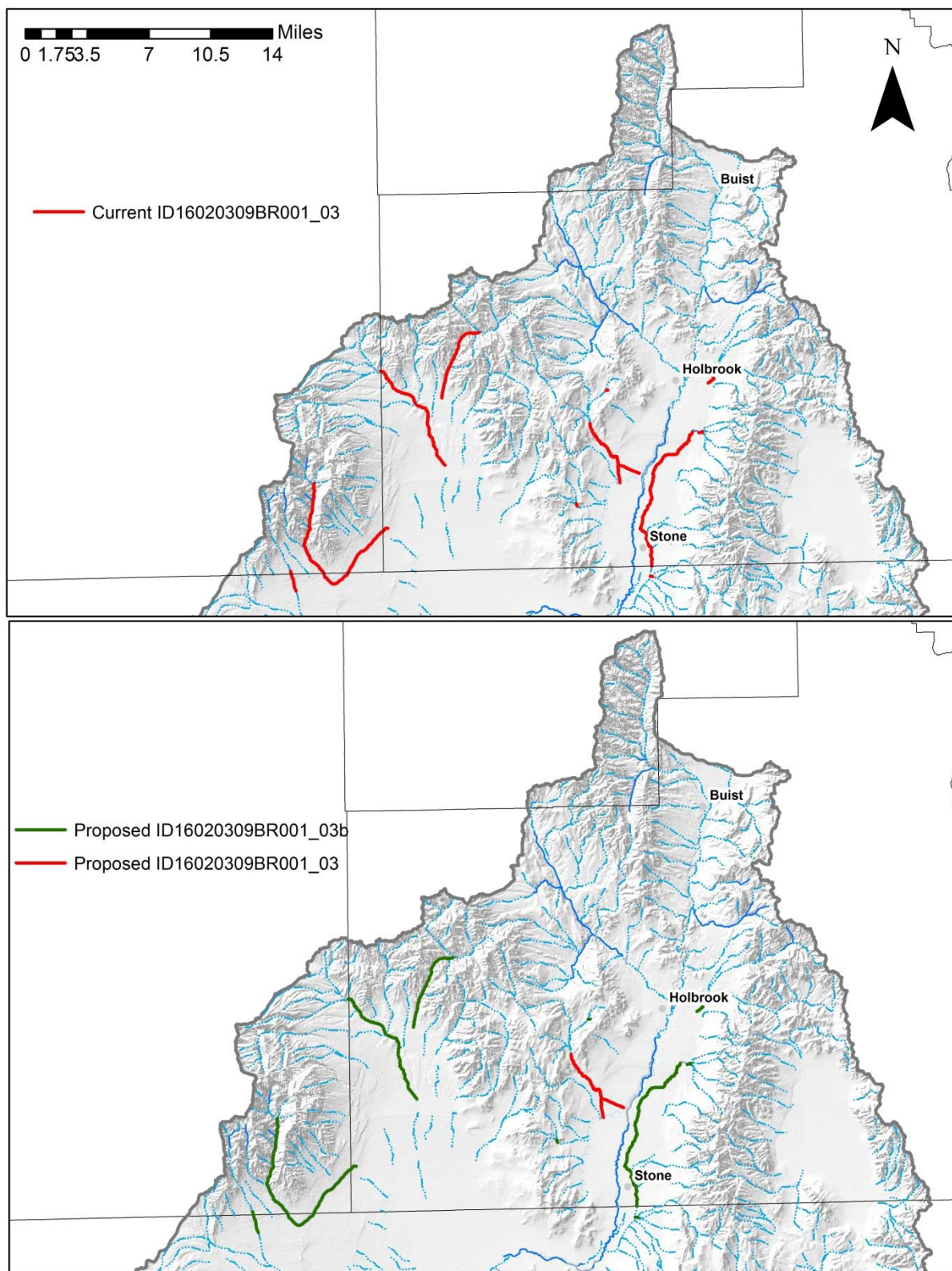


Figure 4. Proposed split of AU ID16020309BR001\_03.

**ID16020309BR001\_03a, Deep Creek (Figure 5)**

- On §303(d) list for sedimentation/siltation.
- All BURP surveys indicate cold water aquatic life is not supported.
- This AU is spring-fed and should not be assessed using BURP protocols.
- Water quality sampling indicates that turbidity, TSS, and nutrients are low near the spring source above the reservoir.
- Below the reservoir, nutrients and sediment levels increase slightly, but still are low, indicating these pollutants are not impacting beneficial uses.
- Flow alterations are impacting cold water aquatic life. The stream is diverted downstream of the spring-head, impounded by a reservoir, and diverted below the reservoir.
- Move from Category 5 for sedimentation/siltation to Category 4c for low flow alterations.



**Figure 5. Deep Creek (ID16020309BR001\_03a) upstream of Stone Reservoir.**

**ID16020309BR002\_02a, Sheep Creek (Figure 6)**

- On §303(d) list for sedimentation/siltation and fecal coliform. Listed in Category 4c for physical substrate habitat alterations.
- BURP data indicate cold water aquatic life is not supported.
- 2016 *E. coli* geometric mean = 1,994 organisms/100 milliliter (mL). *E. coli* TMDL set at water quality standard.
- Water quality sampling indicates that sediment exceeds targets in July 2016 and March 2017.
- TMDLs were developed for *E. coli* and TSS.
- Move sedimentation/siltation from Category 5 to Category 4a for TSS. Replace fecal coliform in Category 5 with *E. coli* in Category 4a.



**Figure 6. Sheep Creek (ID16020309BR002\_02a) on July 8, 2016.**

**ID16020309BR003\_02, Rock Creek—source to mouth (Figure 7)**

- On §303(d) list for combined biota/habitat bioassessments.
- BURP data indicate cold water aquatic life is not supported.
- Put on §303(d) list in 2014 Integrated Report, which was approved in 2017; therefore, it was not included in sampling. This AU will be sampled as part of future TMDL development.
- No change in next Integrated Report.



**Figure 7. Rock Creek (ID16020309BR003\_02) in the vicinity of the spring source.**

**ID16020309BR003\_02a, Meadow Brook Creek (Figure 8)**

- On §303(d) list for *E. coli* and sedimentation/siltation. Listed in Category 4c for physical substrate habitat alterations.
- BURP data indicate cold water aquatic life is not supported.
- 2015 *E. coli* geometric mean = 281 organisms/100 mL. *E. coli* TMDL set at water quality standard.
- Water quality sampling indicates that sediment occasionally exceed targets in this AU.
- TMDLs were developed for *E. coli* and TSS.
- Move sedimentation/siltation from Category 5 to Category 4a for TSS. Move *E. coli* from Category 5 to Category 4a.



**Figure 8. Meadow Brook Creek (ID16020309BR003\_02a) near its confluence with Rock Creek.**

**ID16020309BR003\_03a, Rock Creek (Curlew Valley) (Figure 9)**

- On §303(d) list for sedimentation/siltation and *E. coli*. Listed in Category 4c for physical substrate habitat alterations.
- BURP data indicate cold water aquatic life is not supported.
- 2014 *E. coli* geometric mean = 2,517 organisms/100 mL. *E. coli* TMDL set at water quality standard.
- Water quality sampling indicates sediment exceeds targets.
- TMDLs were developed for *E. coli* and TSS.
- Move sedimentation/siltation from Category 5 to Category 4a for TSS. Move *E. coli* from Category 5 to Category 4a.



Figure 9. Rock Creek (ID16020309BR003\_03a) just upstream of Meadow Brook Creek.

## 4 Subbasin Assessment—Pollutant Source Inventory

Pollution impacting beneficial uses within the Curlew Valley subbasin is primarily from sediment and *E. coli* bacteria.

### 4.1 Point Sources

No point sources of sediment or *E. coli* were identified in the subbasin.

### 4.2 Nonpoint Sources

Various nonpoint sources contribute additional (above background) sediment inputs to streams of the Curlew Valley subbasin. Much of the subbasin is grazed by livestock on public and private lands, which can lead to increased bank erosion. Agriculture may contribute additional sediment to streams through field erosion. Roads and trails in the subbasin, especially streamside, may contribute additional sediment to streams. Stormwater runoff may mobilize pollutants from

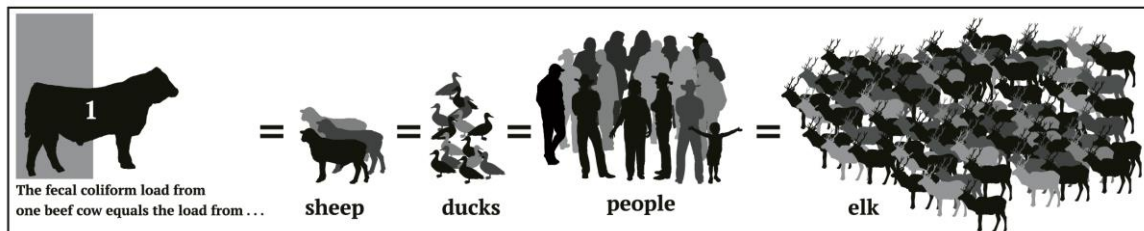
agricultural and other nonpoint source activities in the watershed and transport them to water bodies.

Phosphorus is associated with sediment in the Curlew Valley subbasin. The equation  $TP = 0.0041(\text{turbidity}) + 0.0292$  explains this relationship with an  $R^2$  value of 0.99 ( $n = 29$ ). This direct relationship illustrates that excess phosphorus can be controlled by controlling sedimentation.

Nitrogen is introduced to water bodies through sewage and fertilizers. Chemical fertilizers or animal manure is commonly applied to crops to add nutrients. Heavy precipitation can produce runoff that transports nitrogen to nearby streams. Nitrogen can also be transported to streams by ground water that is impacted by agricultural activities.

*E. coli* is an intestinal bacterium common to warm-blooded animals. Both livestock and wildlife contribute *E. coli* to streams by defecating in and near water. Elevated *E. coli* levels are often associated with riparian grazing and related streambank erosion. *E. coli* also can enter streams through runoff of manure applied to crops.

The rates at which warm-blooded animals produce bacteria depend on many factors including their size, digestive system physiology, and diets. Cattle production of *E. coli* bacteria is greater than sheep, ducks, people, and elk (Zeckoski et al. 2005; Figure 10).



**Figure 10. Relative *E. coli* bacteria loads from various warm-blooded animals (from Zeckoski et al. 2005).**

### 4.3 Pollutant Transport

Pollutant transport refers to the pathway by which pollutants move from the pollutant source to cause a problem or water quality violation in the receiving water body. Sediment makes its way to streams most readily during high flow events, typically during spring snowmelt. During bankfull conditions, streambank erosion from livestock trampling can contribute excess sediment to streams. Overland flow during storms and during snowmelt can pick up sediment from roads, trails, and other disturbed areas and deposit that sediment into streams. Overland flow through lands disturbed by agriculture can contribute excess sediment to streams. Sediment retention in streams is also governed by flow levels. In the absence of high-flushing flows, fine sediment can accumulate in the streambed, negatively impacting biota. Sediment can also carry nutrients, particularly phosphorus to streams. In the Curlew Valley Subbasin, TSS and TP are highly correlated.

Nitrogen is transported to streams primarily through ground water. The primary source of excess nitrogen in the Curlew Valley subbasin is agriculture. Animal manure, excess fertilizer applied to crops and fields, and soil erosion contribute to nitrogen pollution. Nitrogen is dissolved and

transported to the ground water when water is infiltrated. Nitrogen is then transported to streams via springs and upwelling.

*E. coli* is a living organism and many factors influence its transport and concentration in water. *E. coli* enters streams when warm-blooded animals defecate in them or when overland flow moves fecal particles to streams. Once *E. coli* is discharged into water, its density generally decreases as a result of dilution, dispersion, settling, predation, and decay (Hellweger et al. 2009). Therefore, higher flows increase the dilution of *E. coli*. In one study, lower temperatures decreased the die-off rate of *E. coli* (Easton et al. 2005). In some conditions, such as when ambient nutrients are high, growth of surface water-adapted cells is possible (Bucci et al. 2011). In general, *E. coli* decay is thought to be biphasic with a quick initial die-off, followed by slower prolonged decay (Hellweger et al. 2009).

## **5 Subbasin Assessment—Summary of Past and Present Pollution Control Efforts**

In 2016 the NRCS and the Caribou-Targhee National Forest was award grant funding for the National US Forest Service – NRCS Joint Chiefs’ Landscape Restoration Partnership for the Curlew Area Restoration efforts. The Curlew Area Restoration consists of multifaceted and interrelated projects located on the Curlew NG and adjacent private lands which have been developed to holistically improve watershed and natural resource conditions. The projects are focused to create win-win results for both private and public land management benefiting local farmers and ranchers as well the wildlife and the public that use these lands. Numerous projects were initiated in 2016 continue through 2019 including highway reconstruction, agricultural and grazing practices improvements, native vegetation protection and enhancement; stream and riparian restoration and enhancement; and public outreach, education and awareness. The outcomes are aimed at improving watershed conditions, agricultural and grazing practices, sage grouse and other wildlife habitat, monarch butterflies and pollinator habitat, water quality and quantity, and stream and riparian conditions.

In 2017, the United States Forest Service (USFS) conducted a stream restoration project on Rock Creek in the vicinity of Rock Springs (ID16020309BR003\_02), a §303(d)-listed tributary to Rock Creek (ID16020309BR003\_03a). The restoration addressed the degraded stream, eroding streambanks, and degraded riparian conditions on 920 feet of the perennial Rock Creek channel from the spring downstream. It would also reduce erosion and head-cut advancement on 1,040 feet of an ephemeral tributary draw. Treatments included head-cut armoring and revegetation, armored riffles/bank revegetation, and bank stabilization and revegetation.

The USFS is also conducting a stream restoration project on Rock Creek (ID16020309BR003\_03a) from Twin Springs to near its confluence with Meadow Brook Creek (approximately 3.1 miles of restoration). This project began in 2017 and will continue into 2019. The Rock Creek Restoration and Recreation/Wildlife Enhancement Project is associated with a larger cooperative Old Highway 37 Reconstruction Project that crosses the Curlew National Grassland. Five undersized culverts will be replaced, which will help elevate a down-cut channel that has lowered the ground water elevation and disconnected the channel from its floodplain. The floodplain reconnection and creation will expand the current riparian area and double the

acres of wetland. The purpose of the project is to improve water quality by reducing bank erosion. After completion, the project seeks to modify and improve grazing facilities by providing off-stream watering at three locations and installing fencing to eliminate grazing in the riparian corridor.

Deep Creek upstream of Stone Reservoir (ID16020309BR001\_03a) is the focus of an ongoing USFS project to remove invasive Russian olive and salt cedar trees and stabilize eroding streambanks. Stream work will include stabilizing approximately 3,500 feet of streambank and reactivating 650 feet of stream channel while abandoning roughly 400 feet of stream. Revegetation will include willows and sedges. The purpose of the project is to improve overall riparian health and aquatic habitat.

NRCS in Oneida County has worked with private landowners to implement the following practices in the Curlew Valley:

- No-till practices on 983.6 acres of cropland fields in 2016, reducing soil erosion and sediment delivery into Rock Creek
- Nutrient and Pest Management on 1509.3 acres of cropland, reducing the amount of nutrients & herbicide leaving fields and entering surface and ground water
- A more efficient irrigation system has been installed on 121 acres of cropland, increasing the quantity of water in Rock Creek and improve water quality by piping the water directly into the system
- Created plans with private landowners to install stock water systems and fencing on 753 acres which will relieve livestock pressure from Rock Creek

In 2012 the Forest Service stabilized a severe 4-5 foot gully on the intermittent portion of Deep Creek that threatened the Arbon Valley highway. A series of boulder grade control structures were installed to dissipate runoff energy and allow deposition to occur 500-800ft down the intermittent channel. The project objectives were to protect the highway, armor the outlet and stream drainage path, and reduce erosion and downstream impacts.

In 2008 the Forest Service replaced an undersized culvert on the Meadowbrook Road (FS-027) at the Rock Creek crossing. The old culvert was damaged and sinkholes developed in the road during high flow events. A multi-plate bottomless arch culvert was installed to allow for aquatic organism passage. The culvert opening was enlarged to better accommodate the high flows common in this flashy environment.

In the fall of 2006 following the Stone II and Bowen Fires, two undersized stream crossings on Meadowbrook Creek were enlarged to handle increases in stream flows as a result of the fires. The 4ft diameter pipes were replaced with 10.5ft x 7ft squash pipes to increase capacity and also increase stream stability and function, which in-turn improved water quality in Meadowbrook Creek.

Also in 2006, the Forest Service stabilized a headcut on Meadowbrook Creek by creating a step-pool design. The stream channel was armored to prevent migration of the headcut upstream and the subsequent lowering of the local water table. This action decreased erosion and sediment delivery to Meadowbrook Creek.

## 6 Total Maximum Daily Loads

A TMDL prescribes an upper limit (i.e., load capacity) on discharge of a pollutant from all sources to ensure water quality standards are met. It further allocates this load capacity among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a wasteload allocation, and nonpoint sources, each of which receives a load allocation. Natural background contributions, when present, are considered part of the load allocation but are often treated separately because they represent a part of the load not subject to control. Because of uncertainties about quantifying loads and the relation of specific loads to attaining water quality standards, the rules regarding TMDLs (40 CFR Part 130) require a margin of safety be included in the TMDL. Practically, the margin of safety and natural background are both reductions in the load capacity available for allocation to pollutant sources.

Load capacity can be summarized by the following equation:

$$LC = MOS + NB + LA + WLA = TMDL$$

Where:

LC = load capacity

MOS = margin of safety

NB = natural background

LA = load allocation

WLA = wasteload allocation

The equation is written in this order because it represents the logical order in which a load analysis is conducted. First, the load capacity is determined. Then the load capacity is broken down into its components. After the necessary margin of safety and natural background, if relevant, are quantified, the remainder is allocated among pollutant sources (i.e., the load allocation and wasteload allocation). When the breakdown and allocation are complete, the result is a TMDL, which must equal the load capacity.

The load capacity must be based on critical conditions—the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both load capacity and pollutant source loads vary, and not necessarily in concert, determining critical conditions can be more complicated than it may initially appear.

Another step in a load analysis is quantifying current pollutant loads by source. This step allows for the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary for pollutant trading to occur. A load is fundamentally a quantity of pollutant discharged over some period of time and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for “other appropriate measures” to be used when necessary (40 CFR 130.2). These other measures must still be quantifiable and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads and allow “gross allotment” as a load allocation where available data or appropriate

predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

This document contains TMDLs for sediment and *E. coli*.

## 6.1 Instream Water Quality Targets

Water quality targets were selected to restore “full support of designated beneficial uses” (Idaho Code §39-3611 and §39-3615).

The *E. coli* water quality target is set by Idaho’s water quality standards. Full support of the secondary contact recreation beneficial use is assumed to be met when the concentration of *E. coli* bacteria is below 576 organisms/100 mL for a single sample or 126 organisms/100 mL for a geometric mean of five samples taken over a 30-day period (IDAPA 58.01.02.251).

In the case of narrative criteria or evidence of beneficial use impairment, other sources including peer-reviewed literature and state and federal technical guidance documents were consulted to determine appropriate instream targets. Additionally, empirical data from the subbasin were used to establish the statistical relationships between targets (e.g., TSS and TP) or targets and water quality surrogates (e.g., turbidity). Ultimately, the goal was to establish targets that lead to restored conditions within the Curlew Valley subbasin so that “surface waters shall be free from deleterious materials in concentrations that impair beneficial uses” (IDAPA 58.01.02.200.03). Table 6 identifies pollutant targets established in the subbasin. The low flow period is from July to February while high flow months occur from March through June.

**Table 6. Curlew Valley pollutant targets.**

Pollutant	Target	Associated Turbidity Target	Applies to
Total suspended solids	≤25 mg/L (low flow, July to February, seasonal average)	≤10 NTU	ID16020309BR001_03
	≤52 mg/L (high flow, March to June, seasonal average)	≤24 NTU	ID16020309BR002_02a
			ID16020309BR003_02a
			ID16020309BR003_03a
<i>Escherichia coli</i>	≤126 organisms/100 mL	n/a	ID16020309BR002_02a
			ID16020309BR003_02a
			ID16020309BR003_03a

### 6.1.1 Design Conditions

The water quality standard for *E. coli* does not account for seasonality. Rather, the standard must be met at all times. However, exceedances are more likely to occur given certain conditions: when flows are low (decreasing the dilution of bacteria) and when water is warm (decreasing the die-off rate of bacteria). Exceedances are also most likely to occur when livestock or wildlife are concentrated near streams, which varies seasonally.

Effects of sediment in streams are not limited to a particular time of the year. The process of erosion, transport, and deposition of sediment varies seasonally and annually. The majority of bank erosion occurs during bankfull conditions, typically during spring snowmelt. Annual variability in precipitation and timing of precipitation and snowmelt can greatly influence the

amount of sediment delivered to streams. Furthermore, stochastic events such as debris flows can contribute the majority of sediment to streams over long time frames in certain landscapes. Given this variability in sediment and correlated phosphorus loading, seasonal targets were established. Low flow conditions are from July to February and high flow conditions are from March to June. TSS targets are seasonal averages not to exceed 25 mg/L during low flow (July to February) and 52 mg/L during high flow (March to June). Sediment levels are naturally elevated during high flow conditions. In the Curlew Valley, stream flow is elevated during snowmelt. The timing of peak runoff varies yearly based on antecedent snowpack conditions as well as weather conditions. During sampling in 2016 and 2017, highest streamflow in North Canyon, Sheep Creek, and Lower Rock Creek was observed on 3/23/2017. Lowest streamflow levels were observed in July. Since there are no stream gages in the Curlew Valley subbasin, flow periods were chosen based on water quality sampling data (Table 5), hydrologic knowledge, and flow periods used in TMDL targets in a nearby drainage with similar hydrology, the Portneuf River (DEQ 2010).

### 6.1.2 Target Selection

Bacteria targets are set by Idaho's water quality standards (IDAPA 58.01.02.251). *E. coli* is not to exceed 126 organisms/100 mL of water based on the geometric mean of five samples taken over a 30-day period. This criterion applies to both primary and secondary contact recreation. Bacteria TMDLs are based on meeting this criterion at all times.

In lotic systems, making precise estimates of sediment and associated pollutant loads is problematic because of spatial and temporal (i.e., diel, seasonal, annual) variation within a watershed (Jones et al. 2012). Further, unpredictable storm events, short-duration runoff events from land use practices or natural disturbances, and limited resources available for conventional sampling create additional challenges in accurately estimating loads (Preston et al. 1989; Lewis 1997). Still, some sediment delivery processes reoccur annually (e.g., spring runoff) and represent "infrequent but high-magnitude" loading events. For these reasons, EPA and DEQ acknowledge that average sediment loading conditions cannot realistically be imposed in TMDLs for all waters. Instead, approaches that identify seasonal or flow-specific targets are encouraged (Rowe et al. 2003).

This TMDL sets the low-flow TSS target at a seasonal average of  $\leq 25$  mg/L (July - February) and the high flow TSS target at a seasonal average of  $\leq 52$  mg/L (March - June). This target recognizes findings from the growing body of literature that TSS concentrations greater than 25 mg/L may lead to some (measurable) effects on fish habitat (summarized in Rowe et al. 2003, Table 6). While the low flow TSS target of  $\leq 25$  mg/L provides a high level of protection, the high flow target  $\leq 52$  mg/L falls within the range considered moderately protective of fish populations (25 – 80 mg/L) by the European Inland Fisheries Advisory Commission (EIFAC 1964) and other groups (Alabaster 1972, NAS and NAE 1973, Alabaster and Lloyd 1980). This high flow TSS target still provides a moderate level of protection while acknowledging that streams naturally carry higher sediment loads during high flow conditions.

Other TMDL analyses have established similar flow-stratified targets. For example, the Bear River TMDL divided TSS loading among four annually occurring hydrologic periods described as lower basin runoff, upper basin runoff, summer base flow, and winter base flow (Ecosystems Research Institute 2006). The 2010 *Portneuf River TMDL Revision and Addendum* used similar

rationale when setting seasonal targets for TSS (DEQ 2010). This type of approach is endorsed by federal guidance documents for sediment TMDLs, which specifically distinguish between loading events that occur during high flows or high runoff periods and those that occur during low flows (EPA 1999). Recognizing these distinct annual hydrologic periods also acknowledges that high-flow loading events occur when waters are generally cool and prior to the start of the growing season for aquatic macrophytes, algae, and bacteria (Bowes et al. 2008).

Particulate phosphorus (or TP when a small percentage of the phosphorus exists in dissolved form) and TSS are strongly correlated in rivers worldwide (Beusen et al. 2005), and streams in the Curlew Valley are no exception. After removing two outliers that occurred at Meadow Brook Creek, the equation  $TP = 0.0041(\text{turbidity}) + 0.0292$  explains this relationship with an  $R^2$  value of 0.99 ( $n = 29$ ). Furthermore, turbidity and TSS are strongly correlated in the Curlew Valley:  $TSS = 2.0807(\text{turbidity}) + 3.0158$ , with  $R^2 = 0.98$  and  $n = 23$ .

DEQ's approach for establishing informational nutrient targets generally employs the concept of nutrient limitation described as the Redfield ratio (Redfield 1958). This ratio of nitrogen to phosphorus (N:P) is used to identify nutrient limitation within aquatic ecosystems. Using empirical evidence, Redfield and others have shown that aquatic plant growth nutrient demands are met at a molecular N:P ratio of 16:1 (7.2:1 mass ratio). Based on this threshold, ratios above 16 indicate phosphorus limitation, while those below 16 suggest nitrogen limitation (Dodds 2002). In practice, it is believed that dramatic shifts in resource limitation do not occur at 16:1, but that ratios ranging from 10:1 to 20:1 suggest colimitation by both nitrogen and phosphorus (Allan 1995). Still, following the widely accepted 16:1 ratio proposed by Redfield (1958) and the informational TP targets proposed here (0.07 TP during low flow and 0.125 mg/L TP during high flow), DEQ arrived at a range for the TN target from 0.5 to 0.9 mg/L (calculated as:  $0.07$  and  $0.125 \text{ mg/L TP} \times 7.2$  [Redfield multiplier] =  $0.5$  and  $0.9 \text{ mg/L TN}$ ). Recent laboratory bioassays using waters from Upper Snake River subbasins and the free-floating macrophyte *Lemna minor* (duckweed) and its associated epiphytic community revealed that macrophyte and epiphyte biomass varied little in waters with TN concentrations between 0.43 and 1.27 mg/L (Mebane unpublished). Therefore, an informational target of 1.0 mg/L TN was adopted as a compromise between 0.9 mg/L (upper end of the range calculated from the Redfield equation) and 1.27 mg/L (upper end of the no-difference range from relevant experimental research with *Lemna minor*).

### **6.1.3 Water Quality Monitoring Points**

DEQ conducted *E. coli* monitoring on some AUs. Future DEQ *E. coli* monitoring should be used to evaluate if streams are meeting their TMDLs at critical periods of low flow and warm water.

Sediment and nutrient monitoring was conducted at the sites listed in Table 7 in the Curlew Valley in 2016 and 2017. These sites should be used in future studies for consistency and to accurately document changes to water quality.

**Table 7. Locations of monitoring sites used in Curlew Valley TMDL development.**

Site	AU	Description	Latitude	Longitude
North Canyon	ID16020309BR001_03	Off North Canyon Road	42.11456	-112.74955
Deep Creek above Stone Reservoir	ID16020309BR001_03a	Upstream of diversion	42.11786	-112.66640
Deep Creek below Stone Reservoir	ID16020309BR001_03a	Off W 8500 S	42.05801	-112.69960
Sheep Creek	ID16020309BR002_02a	Off Wood Canyon Road	42.23517	-112.56361
Meadow Brook Creek	ID16020309BR003_02a	Near confluence with Rock Creek	42.22320	-112.73085
Lower Rock Creek	ID16020309BR003_03a	Just above Meadow Brook Creek	42.22386	-112.72981
Upper Rock Creek	ID16020309BR003_03a	Near Twin Springs campground	42.25780	-112.76075

## 6.2 Load Capacity

The load capacities for sediment and *E. coli* are set using measures of flow and water quality targets described in Table 6. The following equations demonstrate how loading capacities for *E. coli* and sediment are estimated:

*E. Coli* Load Capacity (organisms/day) = flow (ft<sup>3</sup>/s) \* water quality target (organisms/100 mL) \* Conversion Factor (24,465,715)

Sediment Load Capacity (lbs/day) = flow (ft<sup>3</sup>/s) \* water quality target (mg/L) \* Conversion Factor (5.4)

For *E. coli*, the load capacity is 126 organisms/100 mL for a geometric mean of five samples taken over a 30-day period. For water designated for secondary contact recreation, a single sample over 576 organisms/100 mL warrants additional sampling to evaluate a potential violation of the water quality standard. For waters designated for primary contact recreation, a single sample exceeding 406 organisms/100 mL warrants further sampling (IDAPA 58.01.02.251). The beneficial use of contact recreation is assumed to be met when levels are below this load capacity.

## 6.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings “...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading” (40 CFR 130.2(g)).

### 6.3.1 Sediment Loads

To estimate current sediment loading rates, flow and TSS concentrations were averaged from data displayed in Table 5 among high and low flow periods. Then the high and low flow TSS loads were summed to arrive at an estimated annual load. For example, Sheep Creek had an average high flow (between March and June) TSS concentration of 45 mg/L and an average flow of 2.0 cfs, resulting in an average high flow load of 486 lbs/day. During the low flow period

(between July and February), Sheep Creek had an average TSS concentration of 339 mg/L and an average flow of 0.1 cfs, for an average low flow load of 183 lb/day. To calculate annual loads, daily data were scaled to annual loads by multiplying the average high flow daily loads by 122 (days between March and June). Low flow daily loads were multiplied by 243 (days between July and February). High and low flow sediment estimates were then totaled to estimate annual sediment loads. For Sheep Creek, the high flow load of 486 lb/day was multiplied by 122 days and the low flow load of 183 lb/day was multiplied by 243 days, resulting in an annual load of 103,761 lb/year or 51.9 tons/year. When TSS concentrations were less than the minimum detection level of 5 mg/L, half of this value (2.5 mg/L) was used in load estimation. Estimates of annual sediment loading rates are displayed in Table 8. TMDLs were required if exceedances of targets (Table 6) were observed.

**Table 8. Current annual sediment loads from nonpoint sources in the Curlew Valley subbasin.**

AU	Current Load (tons/year)	Maximum (lb/day)	Minimum (lb/day)	Average flow (cfs)	Average TSS (mg/L)	TMDL Required
ID16020309BR001_03 North Canyon	14.4	205	4	0.1	95.4	Yes
ID16020309BR001_03a Deep Creek above Stone Reservoir	126.8	1,318	321	28.4	3.6	No
ID16020309BR001_03a Deep Creek below Stone Reservoir	66.6	781	70	7.6	9.6	No
ID16020309BR002_02a Sheep Creek	51.9	2,435	4	1.2	162.6	Yes
ID16020309BR003_02a Meadow Brook Creek	5.4	54	5	0.4	35.5	Yes
ID16020309BR003_03a Rock Creek (Curlew Valley)	81.7	5,140	34	1.7	135.2	Yes

### 6.3.2 Nutrient Loads

To estimate current nutrient loads in the Curlew Valley subbasin, average TP and TN concentrations were used in conjunction with flow (Table 5). High and low flow periods were weighted when estimating phosphorus loads as described for sediment.

The N:P ratio was calculated to estimate the nutrient (phosphorus or nitrogen) that may be limiting primary production. Based on discussion of nutrient limitation in section 6.1.2, nutrient ratios in the Curlew Valley subbasin suggest that these waters are likely limited by nitrogen. The exception to this is Deep Creek above Stone Reservoir where phosphorus is likely limiting primary production. Table 9 displays TP and TN load estimates in the Curlew Valley subbasin.

**Table 9. Current annual phosphorus and nitrogen loads from nonpoint sources in the Curlew Valley subbasin.**

AU	Current TP Load (lb/year)	Mean TP (mg/L)	Current TN Load (tons/year)	Mean TN (mg/L)	Mean TN:TP
ID16020309BR001_03 North Canyon	23	0.095	0.1	1.1	12
ID16020309BR001_03a Deep Creek above Stone Reservoir	610	0.011	9.9	0.4	32
ID16020309BR001_03a Deep Creek below Stone Reservoir	683	0.053	3.5	0.5	9
ID16020309BR002_02a Sheep Creek	279	0.375	2.3	1.8	5
ID16020309BR003_02a Meadow Brook Creek	67	0.260	0.2	1.2	4
ID16020309BR003_03a Rock Creek (Curlew Valley)	719	0.264	3.1	1.5	6

### 6.3.3 *E. coli* Concentrations

Geometric means were computed based on five samples collected over 30 days for AUs in the Curlew Valley subbasin that were listed as impaired for *E. coli* or fecal coliform. Geometric mean samples also were calculated for AUs that exceeded the secondary contact recreation trigger value of 576 organisms/100 mL when they were initially sampled for *E. coli* to assess the support status of secondary contact recreation. Geometric means in excess of 126 organisms/100 mL indicate that a TMDL is required (Table 10).

**Table 10. Most recent geometric means for *E. coli* in the Curlew Valley subbasin.**

AU Number	Existing Concentration (organisms/100 mL)	TMDL Required
ID16020309BR002_02a Sheep Creek	1,994	Yes
ID16020309BR003_02a Meadow Brook Creek	281	Yes
ID16020309BR003_03a Rock Creek (Curlew Valley)	2,517	Yes

## 6.4 Load Allocations and Wasteload Allocations

To establish TMDLs for AUs impaired by sediment, estimates of existing loads were established by season (low and high flow, Table 12 and Table 13) and compared to target loads dictated by measured flow and target concentrations (Table 6). There are no known point sources in the Curlew Valley Subbasin; therefore, no wasteload allocations were developed. If an AU was meeting target loads during a particular season (high or low flow), the existing load became the target load. For example, during high flow the average TSS concentration in North Canyon was below the target concentration of 52 mg/L. For the high flow season, the existing average

concentration (19 mg/L) became the target concentration. For high flow, daily target loads (lbs/day) were multiplied by 122 (days between March and June) to arrive at a seasonal load. For low flow, daily target loads (lbs/day) were multiplied by 243 (days between July and February) to arrive at a seasonal load. The high and low flow TSS loads, were then summed to arrive at target annual loads (Table 14).

TSS target exceedances were more common during low flow than during high flow (Table 12 and Table 13). Table 14 displays TSS TMDLs established for the Curlew Valley subbasin annually. Significant annual sediment reductions are required in 4 AUs (North Canyon, Sheep Creek, Meadow Brook Creek, and Rock Creek).

**Table 11. Curlew Valley Subbasin TSS TMDL for high flows, low flows, and annual flows.**

Assessment Unit	Flow	Average flow (ft <sup>3</sup> /s)	Target Conc. (mg/L)	LC (lbs/day)	LA (lbs/day)	WLA (lbs/day)	NB <sup>a</sup> (lbs/day)	MOS <sup>b</sup>	TMDL (lbs/day)
ID16020309BR001_03 North Canyon	High	0.1	19 <sup>c</sup>	10	10	0	-	-	10
	Low	0.1	25	13	13	0	-	-	13
	Annual	0.1	24	13	13	0	-	-	13
ID16020309BR002_02a Sheep Creek	High	2.0	45 <sup>c</sup>	486	486	0	-	-	486
	Low	0.1	25	13	13	0	-	-	13
	Annual	1.0	32	171	171	0	-	-	171
ID16020309BR003_02a Meadow Brook Creek	High	0.6	19 <sup>c</sup>	62	62	0	-	-	62
	Low	0.04	25	5	5	0	-	-	5
	Annual	0.19	24	24	24	0	-	-	24
ID16020309BR003_03a Rock Creek (Curlew Valley)	High	2.1	52	590	590	0	-	-	590
	Low	1.2	25	162	162	0	-	-	162
	Annual	1.7	34	305	305	0	-	-	305

Note: <sup>a</sup> TMDLs did not allocate any load to NB. <sup>b</sup> Implicit Margin of Safety. <sup>c</sup> Existing concentrations were set as target concentrations in cases where mean concentrations were below established targets.

**Table 12. Nonpoint source sediment load allocations (high flow) for the Curlew Valley subbasin.**

AU	High Flow (March–June)					Percent Reduction Necessary to Meet Target
	Existing Mean TSS (mg/L)	Existing Mean Flow (cfs)	Existing TSS Load (lbs/day)	Target TSS Load (lbs/day)	Target Seasonal Load (lbs)	
ID16020309BR001_03 North Canyon	19	0.1	10	10	1,252	0
ID16020309BR002_02a Sheep Creek	45	2.0	486	486	59,292	0
ID16020309BR003_02a Meadow Brook Creek	19	0.6	62	62	7,564	0
ID16020309BR003_03a Rock Creek (Curlew Valley)	187	2.1	2,121	590	71,980	72

**Table 13. Nonpoint source sediment load allocations (low flow) for the Curlew Valley subbasin.**

AU	Low Flow (July–February)					Percent Reduction Necessary to Meet Target
	Existing Mean TSS (mg/L)	Existing Mean Flow (cfs)	Existing TSS Load (lb/day)	Target TSS Load (lb/day)	Target Seasonal Load (lb)	
ID16020309BR001_03 North Canyon	210	0.1	113	13	3,159	88
ID16020309BR002_02a Sheep Creek	339	0.1	183	13	3,159	93
ID16020309BR003_02a Meadow Brook Creek	61	0.04	13	5	1,215	62
ID16020309BR003_03a Rock Creek (Curlew Valley)	58	1.2	376	162	39,366	57

**Table 14. Nonpoint source sediment load allocations (annual basis) for the Curlew Valley subbasin.**

AU	Existing High Flow Seasonal Load (lbs)	Existing Low Flow Seasonal Load (lbs)	Target High Flow Seasonal Load (lbs)	Target Low Flow Seasonal Load (lbs)	Existing Annual TSS Load (tons/year)	Target Annual TSS Load (tons/year)	Percent Reduction Necessary to Meet Target
ID16020309BR001_03 North Canyon	1,252	27,459	1,252	3,159	14.4	2.2	85
ID16020309BR002_02a Sheep Creek	59,292	44,469	59,292	3,159	51.9	31.2	40
ID16020309BR003_02a Meadow Brook Creek	7,564	3,159	7,564	1,215	5.4	4.4	23
ID16020309BR003_03a Rock Creek (Curlew Valley)	258,762	91,368	71,390	39,366	175.1	55.4	68

To establish informational TMDLs for AUs impaired by phosphorus, estimates of existing loads were established by season (low and high flow) and compared to target loads calculated by measured flow and target concentrations (0.125 mg/L during high flow and 0.070 mg/L during low flow). If an AU was meeting target loads during a particular season, the existing load became the target load. TP target exceedances were more common during low flow than during high flow (Table 15 and Table 16) indicating that excess sediment loading is a chronic condition that is not only triggered by hydrologic events. Table 17 displays informational TP TMDLs established for the Curlew Valley subbasin annually. Significant phosphorus reductions are required in 4 AUs (North Canyon, Sheep Creek, Meadow Brook Creek, and Rock Creek). These reductions will be met if the TMDL for TSS is achieved.

**Table 15. Informational nonpoint source phosphorus load allocations (high flow) for the Curlew Valley subbasin.**

AU	High Flow (March–June)					Percent Reduction Necessary to Meet Target
	Existing Mean TP (mg/L)	Existing Mean Flow (cfs)	Existing TP Load (lb/day)	Target TP Load (lb/day)	Target Seasonal TP Load (lb)	
ID16020309BR001_03 North Canyon	0.056	0.1	0.03	0.03	3.7	0
ID16020309BR002_02a Sheep Creek	0.140	2.0	1.51	1.35	164.7	11
ID16020309BR003_02a Meadow Brook Creek	0.103	0.6	0.33	0.33	40.7	0
ID16020309BR003_03a Rock Creek (Curlew Valley)	0.330	2.1	3.74	1.42	173.2	62

**Table 16. Informational nonpoint source phosphorus load allocations (low flow) for the Curlew Valley subbasin.**

AU	Low Flow (July–February)					Percent Reduction Necessary to Meet Target
	Existing Mean TP (mg/L)	Existing Mean Flow (cfs)	Existing TP Load (lb/day)	Target TP Load (lb/day)	Target Seasonal TP Load (lb)	
ID16020309BR001_03 North Canyon	0.154	0.1	0.08	0.04	9.7	50
ID16020309BR002_02a Sheep Creek	0.728	0.1	0.39	0.04	9.7	90
ID16020309BR003_02a Meadow Brook Creek	0.495	0.04	0.11	0.02	4.9	82
ID16020309BR003_03a Rock Creek (Curlew Valley)	0.166	1.2	1.08	0.45	109.4	58

**Table 17. Informational nonpoint source phosphorus load allocations (annual) for the Curlew Valley subbasin.**

AU	Existing High Flow Seasonal Load (lbs)	Existing Low Flow Seasonal Load (lbs)	Target High Flow Seasonal Load (lbs)	Target Low Flow Seasonal Load (lbs)	Existing TP Load (lb/year)	Target TP Load (lb/year)	Percent Reduction Necessary to Meet Target
ID16020309BR001_03 North Canyon	3.7	19.4	3.7	9.7	23.1	13.4	42
ID16020309BR002_02a Sheep Creek	184.2	94.8	164.7	9.7	279.0	174.4	37
ID16020309BR003_02a Meadow Brook Creek	40.7	26.7	40.7	4.9	67.4	45.6	32
ID16020309BR003_03a Rock Creek (Curlew Valley)	456.3	262.4	173.2	109.4	718.7	282.6	61

Load allocations for *E. coli* are set at Idaho's water quality standard of 126 organisms/100 mL based on five samples collected over 30 days. Significant reductions in Sheep Creek, Meadow Brook Creek, and Rock Creek are needed to meet the water quality standard and TMDL targets (Table 18). TMDLs for *E. coli* were also established based on flow (Table 19).

**Table 18. *E. coli* nonpoint source load allocations for the Curlew Valley subbasin.**

AU Name	AU Number	Existing Concentration (organisms/100 mL)	Target Concentration (organisms/100 mL)	Necessary Concentration Reduction (%)
Sheep Creek	ID16020309BR002_02a	1,994	126	94
Meadow Brook Creek	ID16020309BR003_02a	281	126	55
Rock Creek (Curlew Valley)	ID16020309BR003_03a	2,517	126	95

**Table 19. *E. coli* TMDL allocations for the Curlew Valley subbasin, based on flow.**

Assessment Unit	Flow (ft <sup>3</sup> /s)	Target Conc. (org./100mL)	LC (org./day)	LA (org./day)	WLA (org./day)	NB <sup>a</sup> (org./day)	MOS <sup>b</sup>	TMDL (lbs/day)
ID16020309BR002_02a Sheep Creek	0.1	126	3.08E+08	3.08E+08	0	-	-	3.08E+08
	1.0	126	3.08E+09	3.08E+09	0	-	-	3.08E+09
	10.0	126	3.08E+10	3.08E+10	0	-	-	3.08E+10
ID16020309BR003_02a Meadow Brook Creek	0.1	126	3.08E+08	3.08E+08	0	-	-	3.08E+08
	1.0	126	3.08E+09	3.08E+09	0	-	-	3.08E+09
	10.0	126	3.08E+10	3.08E+10	0	-	-	3.08E+10
ID16020309BR003_03a Rock Creek (Curlew Valley)	0.1	126	3.08E+08	3.08E+08	0	-	-	3.08E+08
	1.0	126	3.08E+09	3.08E+09	0	-	-	3.08E+09
	10.0	126	3.08E+10	3.08E+10	0	-	-	3.08E+10

Note: <sup>a</sup>TMDLs did not allocate any load to NB. <sup>b</sup> Implicit Margin of Safety

### 6.4.1 Margin of Safety

An implicit or explicit portion of a water body's load capacity is set aside to allow for uncertainty about the relationship between the pollutant loads and the quality of the receiving water body. The margin of safety (MOS) is a required component of a TMDL and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations or models). The MOS is not allocated to any sources of pollution. Conservative assumptions made as part of the load analysis are discussed below.

In the case of *E. coli*, the pollutant load capacity was calculated for the most critical period and is applied year-round. Existing loads are based on sampling done during periods when bacteria concentrations are likely to be higher (e.g., heavy grazing or warm temperatures). Applying these conservative methods is considered an implicit MOS. Further, *E. coli* standards are derived from risk-based exposure studies that include a MOS.

Target TSS concentrations include an implicit margin of safety because they are below targets established for nearby watersheds with similar hydrology and sources of pollution. For example in the Portneuf River, the low flow TSS target is 35 mg/L and the high flow TSS target is 80 mg/L (DEQ 2010). Targets in the Curlew Valley subbasin are 10 mg/L lower during low flow and 28 mg/L lower during high flow. In the Bear River Basin, TSS targets were established at 60 mg/L at base flow and 80 mg/L during runoff (Ecosystem Research Institute 2006). Targets in the Curlew Valley subbasin are 35 mg/L lower during low flow and 28 mg/L lower during high flow. Similar to the Bear River, the Curlew drains to the Great Salt Lake and has similar geology. Since TSS targets are significantly lower than other approved TMDLs, these targets include an implicit margin of safety.

### 6.4.2 Seasonal Variation

*E. coli* concentrations are highest when flows are low, water is warm, and warm-blooded animals are concentrated near the stream. DEQ measures *E. coli* concentrations when these conditions exist, recreational use is likely, and exceedances are most likely to occur. This period is also when the beneficial use of contact recreation is most likely to be impaired by *E. coli*. Summer is the critical time for *E. coli*, but the exceedance criteria exists year-round.

Erosion and sediment delivery to the stream are functions of climatic variability and the geomorphic properties of the stream and its drainage area. Years with high precipitation often produce higher than average erosion and higher sediment loads in streams with unstable banks. Streams with stable banks and floodplain connectivity are more able to withstand large hydrologic events without becoming unstable. Sediment load is not evenly distributed throughout the year. Most erosion occurs during spring runoff at bankfull conditions.

Sediment and informational phosphorus targets consider that water quality parameters vary seasonally. These constituents are expected to be higher at high flows when geomorphic processes are most active.

### 6.4.3 Reasonable Assurance

Implementation will begin after DEQ, EPA, and stakeholders accept this TMDL. Idaho's water quality standards designate agencies that are responsible for evaluating and modifying best

management practices (BMPs) to restore impaired water bodies to full support of beneficial uses. Implementation strategies should incorporate field verification of the load analyses included in this TMDL.

The 5-year review of this TMDL will report ongoing assessments of beneficial use support status of water bodies included here. If full support status has not been obtained, further implementation actions will be needed and reassessment performed until all impaired water bodies attain full support status. If full support status is achieved, the requirements of the TMDL will be considered complete.

#### **6.4.4 Natural Background**

At this time, natural background loads for sediment and *E. coli* are unknown for waterbodies in the Curlew Valley Subbasin. Since natural background loads were unable to be quantified, individual allocations for natural background were not included in the Curlew Valley subbasin TMDLs. The unquantified natural background loads are therefore considered to be included in TMDL's load allocation calculations.

#### **6.4.5 Construction Stormwater and TMDL Wasteload Allocations**

Stormwater runoff is water from rain or snowmelt that does not immediately infiltrate into the ground and flows over or through natural or man-made storage or conveyance systems. When undeveloped areas are converted to land uses with impervious surfaces—such as buildings, parking lots, and roads—the natural hydrology of the land is altered and can result in increased surface runoff rates, volumes, and pollutant loads. Certain types of stormwater runoff are considered point source discharges for CWA purposes, including stormwater that is associated with municipal separate storm sewer systems (MS4s), industrial stormwater covered under the Multi-Sector General Permit (MSGP), and construction stormwater covered under the Construction General Permit (CGP). See Appendix C for more detailed descriptions of these types of stormwater runoff.

### **6.5 Implementation Strategies**

TMDLs in this document are for sediment and bacteria. For streambank stability to increase and associated pollutants to decrease (TSS), implementation strategies should focus on reducing riparian grazing along stream segments with sediment TMDLs. Planting riparian vegetation can help stabilize streambanks. Efforts to limit or exclude livestock from riparian corridors will also help alleviate bacteria problems in streams. Nitrogen can be reduced if improved nutrient management practices are implemented on agricultural land.

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that TMDL goals are not being met or significant progress is not being made toward achieving the goals. Reasonable assurance (addressed in section 6.4.3) for the TMDL to meet water quality standards is based on the implementation strategy.

### 6.5.1 Time Frame

The expected time frame for attaining water quality standards and restoring beneficial uses is a function of management intensity, climate, ecological potential, and natural variability of environmental conditions. If BMP implementation is embraced, some improvements may be seen in as few as several years. Even with aggressive implementation, however, some natural processes required to satisfy this TMDL's requirements may not be realized for several decades. The deleterious effects of historic land management practices have accrued over many years, and recovery of natural systems may take longer than administrative needs allow.

Similarly, the expected time frame for restoring the Curlew Valley subbasin and its component streams to conditions that support all beneficial uses highly depends on several variables, principally the efforts by those responsible for implementing such measures. In an ideal situation where implementation occurs within 5 years of TMDL approval, vegetation recovery to natural conditions could occur within 20 years of riparian restoration and effective livestock control. Additionally, some AUs are included in Category 4c for pollution because of habitat alterations such as damming, channelization, or diversion. Some of these AUs should not be expected to achieve full support of beneficial uses as *pollution* is not addressed via the TMDL framework.

### 6.5.2 Approach

By improving riparian management practices, overall riparian zone recovery will further streambank stabilization and reduce fine sediment inputs, ultimately improving stream habitat. Implementing riparian zone recovery practices will contribute to overall improvement in stream morphology and habitat, shifting stream health towards beneficial use attainment. In cases where excess sediment is contributed through roads and watershed contributions, additional changes to land management practices may be needed. To reduce inputs of *E. coli* to AUs impaired for secondary contact recreation, grazing management changes such as reduced season of use or exclusionary fencing may be needed.

The designated management agencies, watershed advisory group (WAG), and other appropriate public process participants are expected to implement the following:

- Develop BMPs to achieve load allocations.
- Provide reasonable assurance that management measures will meet load allocations through both quantitative and qualitative analyses of management measures.
- Adhere to measureable milestones for progress.
- Develop a timeline for implementation with reference to costs and funding.
- Develop a monitoring plan to determine if BMPs are being implemented, if individual BMPs are effective, if load allocations and wasteload allocations are being met, and whether water quality standards are being met.

### 6.5.3 Responsible Parties

Several designated land management agencies are involved where watershed implementation is concerned. The Idaho Soil and Water Conservation Commission, IDL, Idaho Transportation Department, BLM, and USFS are identified as the state and federal entities that will be involved in or responsible for implementing the TMDL. The designated management agencies will recommend specific control actions and will then submit the implementation plan to DEQ. DEQ

will act as a repository for approved implementation plans and conduct 5-year reviews of progress towards TMDL goals.

In addition to the designated management agencies, the public (through the WAG) will have the opportunity to be involved with implementation plan development.

#### **6.5.4 Implementation Monitoring Strategy**

The objectives of monitoring are to demonstrate long-term recovery, better understand natural variability, track implementation of projects and BMPs, and track overall effectiveness of TMDL implementation. This monitoring and evaluation mechanism is a major component of the reasonable assurance of implementation for the TMDL implementation plan.

The implementation plan will be tracked by accounting for the numbers, types, and locations of watershed improvement projects; educational activities; or other actions taken to improve or protect water quality. Reports submitted to DEQ will be the mechanism for tracking specific implementation efforts.

The monitoring and evaluation mechanism has two basic components:

1. Track the implementation progress of specific watershed improvement plans.
2. Track the progress of improving water quality through monitoring physical, chemical, and biological parameters.

Monitoring reports will provide information on progress toward achieving TMDL allocations and water quality standards and will provide evaluation, an important component of an adaptive management approach. DEQ monitors AUs through BURP. DEQ compiles data and determines support status using the *Water Body Assessment Guidance* (DEQ 2016a). BURP data can also be used to track changes in watershed conditions through time. Additionally, DEQ may collect additional data using SEIs and McNeil core samples to assess whether sedimentation problems are improving. DEQ will also take samples for *E. coli* analyses from AUs with *E. coli* TMDLs to evaluate BMP effectiveness.

While DEQ has the primary responsibility for watershed monitoring, other agencies and entities have shown interest in such monitoring. In these instances, data sharing is encouraged. The designated agencies have primary responsibility for BMP monitoring.

#### **6.5.5 Pollutant Trading**

Pollutant trading (also known as water quality trading) is a contractual agreement to exchange pollution reductions between two parties. Pollutant trading is a business-like way of helping to solve water quality problems by focusing on cost-effective, local solutions to problems caused by pollutant discharges to surface waters. Pollutant trading is one of the tools available to meet reductions called for in a TMDL where point and nonpoint sources both exist in a watershed.

The appeal of trading emerges when pollutant sources face substantially different pollutant reduction costs. Typically, a party facing relatively high pollutant reduction costs compensates another party to achieve an equivalent, though less costly, pollutant reduction.

Pollutant trading is voluntary. Parties trade only if both are better off because of the trade, and trading allows parties to decide how to best reduce pollutant loadings within the limits of certain requirements.

Pollutant trading is recognized in Idaho's water quality standards at IDAPA 58.01.02.055.06. DEQ allows for pollutant trading as a means to meet TMDLs, thus restoring water quality limited water bodies to compliance with water quality standards. DEQ's *Water Quality Trading Guidance* sets forth the procedures to be followed for pollutant trading (DEQ 2016b).

See Appendix D for more details about this practice.

## 7 Conclusions

The Curlew Valley subbasin is located in southeast Idaho and northern Utah. Streams located in the Idaho portion of the drainage flow out of the North Hansel and Black Pine mountains bounding the Curlew Valley and south into Utah. The subbasin is sparsely populated, contains no cities, and has only two unincorporated communities, Holbrook and Stone. Economic activities in the subbasin include livestock grazing, agriculture, and recreation.

Historically, Curlew Valley water bodies likely supported several beneficial uses. All streams presumably supported cold water aquatic life, agricultural water supply, and secondary contact recreation. Some streams also supported domestic water supply. In the most recent Integrated Report, 6 AUs were on the §303(d) list as not supporting beneficial uses and in need of a TMDL. The subbasin's remaining 6 AUs were listed in Category 3 as unassessed. No AUs in the subbasin are currently known to be supporting beneficial uses.

DEQ conducted water quality sampling in the Curlew Valley subbasin in 2016 and 2017 to estimate current pollutant loads. Results from North Canyon, Sheep Creek, Meadow Brook Creek, and Rock Creek indicated excess loads of TSS. *E. coli* loads in excess of water quality standards were documented at Sheep Creek, Meadow Brook Creek, and Rock Creek. TMDLs were developed for these pollutants.

Water quality sampling at Deep Creek (ID16020309BR001\_03a) did not indicate excess sediment or nutrient loads. Deep Creek is a spring-fed stream, and BURP metrics cannot be used to measure support of cold water aquatic life. This stream has a highly modified flow regime. It is heavily diverted and impounded by Stone Reservoir. It should be listed for low flow alterations in Category 4c in the next Integrated Report and removed from Category 5 for sedimentation/siltation.

Table 20 summarizes the assessment outcomes for §303(d)-listed streams in the Curlew Valley subbasin. TMDLs were developed for 4 AUs that should be removed from the §303(d) list in the next Integrated Report.

The USFS and its partners are currently completing several restoration projects in the subbasin focused on reducing stream incision, removing invasive species, increasing stream length, and improving grazing management. These projects are taking place on Rock Creek (ID16020309BR003\_02 and ID16020309BR003\_03a) and Deep Creek (ID16020309BR001\_03a). The NRCS has worked with private landowners to implement no-till

practices, reduce the amount of nutrient pollution from agriculture, and improve irrigation and grazing practices to benefit water quality in the Curlew Valley subbasin.

**Table 20. Summary of assessment outcomes.**

AU Name	AU Number	Pollutants	Pollution	TMDLs Completed	Recommended Changes to Next Integrated Report	Justification
North Canyon	ID16020309BR001_03	Sedimentation/siltation	Low flow alterations	TSS	Move from Category 5 for sedimentation/siltation to Category 4a for TSS. Split North Canyon from the rest of the AU and name the remaining portion ID16020309BR001_03b. Place ID16020309BR001_03b in Category 3 as unassessed.	TMDLs completed for TSS for North Canyon. ID16020309BR001_03b is intermittent and has never been surveyed by BURP.
Deep Creek	ID16020309BR001_03a	Sedimentation/siltation	Low flow alterations	None	Move from Category 5 for sedimentation/siltation to Category 4c for Low flow alterations.	Water quality monitoring indicates sedimentation/siltation is not impacting this AU. This AU is impounded by a reservoir and is heavily diverted for irrigation. AU is spring-fed and should not be assessed using BURP protocols.
Sheep Creek	ID16020309BR002_02a	Fecal coliform, sedimentation/siltation	Physical substrate habitat alterations	TSS, <i>E. coli</i>	Move from Category 5 for fecal coliform and sedimentation/siltation to Category 4a for TSS and <i>E. coli</i> .	TMDLs completed for TSS and <i>E. coli</i> .
Rock Creek—source to mouth	ID16020309BR003_02	Combined biota/habitat bioassessments	n/a	None	None	Not assessed until 2017, so not included in sampling.
Meadow Brook Creek	ID16020309BR003_02a	<i>E. coli</i> , sedimentation/siltation	Physical substrate habitat alterations	TSS, <i>E. coli</i>	Move from Category 5 for <i>E. coli</i> and sedimentation/siltation to Category 4a for TSS and <i>E. coli</i> .	TMDLs completed for TSS, and <i>E. coli</i> .
Rock Creek (Curlew Valley)	ID16020309BR003_03a	Sedimentation/siltation, <i>E. coli</i>	Physical substrate habitat alterations	TSS, <i>E. coli</i>	Move from Category 5 for sedimentation/siltation and <i>E. coli</i> to Category 4a for TSS and <i>E. coli</i> .	TMDLs completed for TSS and <i>E. coli</i> .

This document was prepared with input from the public, as described in Appendix E. Following the public comment period, comments and DEQ responses will also be included in this appendix, and a distribution list will be included in Appendix F.

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## GIS Coverages

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## Glossary

### §303(d)

Refers to section 303 subsection “d” of the Clean Water Act. Section 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to United States Environmental Protection Agency approval.

### Assessment Unit (AU)

A group of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs. All the waters of the state are defined using AUs, and because AUs are a subset of water body identification numbers, they tie directly to the water quality standards so that beneficial uses defined in the water quality standards are clearly tied to streams on the landscape.

### Beneficial Use

Any of the various uses of water that are recognized in water quality standards, including, but not limited to, aquatic life, recreation, water supply, wildlife habitat, and aesthetics.

### Beneficial Use Reconnaissance Program (BURP)

A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers.

### Exceedance

A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.

### Fully Supporting

In compliance with water quality standards and within the range of biological reference conditions for all designated and existing beneficial uses as determined through the *Water Body Assessment Guidance* (DEQ 2016a).

### Load Allocation (LA)

A portion of a water body’s load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).

### Load(ing)

The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.

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**Load Capacity (LC)**

How much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, a margin of safety, and natural background contributions, it becomes a total maximum daily load.

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**Margin of Safety (MOS)**

An implicit or explicit portion of a water body's load capacity set aside to allow for uncertainty about the relationship between the pollutant loads and the quality of the receiving water body. The margin of safety is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The margin of safety is not allocated to any sources of pollution.

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**Nonpoint Source**

A dispersed source of pollutants generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and nonirrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.

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**Not Assessed (NA)**

A concept and an assessment category describing water bodies that have been studied but are missing critical information needed to complete an assessment.

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**Not Fully Supporting**

Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (DEQ 2016a).

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**Point Source**

A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater plants.

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**Pollutant**

Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

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**Pollution**

A very broad concept that encompasses human-caused changes in the environment that alter the functioning of natural processes and

produce undesirable environmental and health effects. Pollution includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.

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**Stream Order**

Hierarchical ordering of streams based on the degree of branching. A 1st-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher-order streams result from the joining of two streams of the same order.

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**Total Maximum Daily Load (TMDL)**

A TMDL is a water body's load capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual basis. A TMDL is equal to the load capacity, such that  $\text{load capacity} = \text{margin of safety} + \text{natural background} + \text{load allocation} + \text{wasteload allocation} = \text{TMDL}$ . In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

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**Wasteload Allocation (WLA)**

The portion of receiving water's load capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a water body.

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**Water Body**

A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.

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**Water Quality Criteria**

Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, aquatic habitat, or industrial processes.

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**Water Quality Standards**

State-adopted and United States Environmental Protection Agency-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

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## **Appendix A. Beneficial Uses**

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses.

### **Existing Uses**

Existing uses under the Clean Water Act are “those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards” (40 CFR 131.3). The existing instream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.051.01). Existing uses need to be protected, whether or not the level of water quality to fully support the uses currently exists. A practical application of this concept would be to apply the existing use of salmonid spawning to a water that supported salmonid spawning on November 28, 1975, but does not now due to other factors, such as blockage of migration, channelization, sedimentation, or excess heat.

### **Designated Uses**

Designated uses under the Clean Water Act are “those uses specified in water quality standards for each water body or segment, whether or not they are being attained” (40 CFR 131.3). Designated uses are simply uses officially recognized by the state. In Idaho, these include uses such as aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Multiple uses often apply to the same water; in this case, water quality must be sufficiently maintained to meet the most sensitive use (designated or existing). Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are described in the Idaho water quality standards (IDAPA 58.01.02.100) and specifically listed by water body in sections 110–160.

### **Undesignated Surface Waters and Presumed Use Protection**

In Idaho, due to a change in scale of cataloging waters in 2000, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations (IDAPA 58.01.02.110–160). The water quality standards have three sections that address undesignated waters. Sections 101.02 and 101.03 specifically address undesignated man-made waterways and private waters. Man-made waterways and private waters have no presumed use protections. Man-made waters are protected for the use for which they were constructed unless otherwise designated in the water quality standards. Private waters are not protected for any beneficial uses unless specifically designated in the water quality standards.

All other undesignated waters are addressed by section 101.01. Under this section, absent information on existing uses, DEQ presumes that most Idaho waters will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To

protect these so-called presumed uses, DEQ applies the numeric cold water and recreation criteria to undesignated waters. If in addition to presumed uses, an additional existing use (e.g., salmonid spawning) exists, then the additional numeric criteria for salmonid spawning would also apply (e.g., intergravel dissolved oxygen [DO], temperature) because of the requirement to protect water quality for that existing use. However, if some other use that requires less stringent criteria for protection (such as seasonal cold aquatic life) is found to be an existing use, then a use designation (rulemaking) is needed before that use can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01).

## Appendix B. Water Quality Criteria

**Table B1. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards.**

Parameter	Primary Contact Recreation	Secondary Contact Recreation	Cold Water Aquatic Life	Salmonid Spawning <sup>a</sup>
<b>Water Quality Standards: IDAPA 58.01.02.250–251</b>				
<b>Bacteria</b>				
• Geometric mean	<126 <i>E. coli</i> /100 mL <sup>b</sup>	<126 <i>E. coli</i> /100 mL	—	—
• Single sample <sup>c</sup>	≤406 <i>E. coli</i> /100 mL	≤576 <i>E. coli</i> /100 mL	—	—
<b>pH</b>	—	—	Between 6.5 and 9.0	Between 6.5 and 9.5
<b>Dissolved oxygen (DO)</b>	—	—	DO exceeds 6.0 milligrams/liter (mg/L)	<b>Water Column DO:</b> DO exceeds 6.0 mg/L in water column or 90% saturation, whichever is greater <b>Intergravel DO:</b> DO exceeds 5.0 mg/L for a 1-day minimum and exceeds 6.0 mg/L for a 7-day average
<b>Temperature<sup>d</sup></b>	—	—	22 °C or less daily maximum; 19 °C or less daily average <b>Seasonal Cold Water:</b> Between summer solstice and autumn equinox: 26 °C or less daily maximum; 23 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average <b>Bull Trout:</b> Not to exceed 13 °C maximum weekly maximum temperature over warmest 7-day period, June–August; not to exceed 9 °C daily average in September and October
<b>Turbidity</b>	—	—	Turbidity shall not exceed background by more than 50 nephelometric turbidity units (NTU) instantaneously or more than 25 NTU for more than 10 consecutive days.	—
<b>Ammonia</b>	—	—	Ammonia not to exceed calculated concentration based on pH and temperature.	—

a. During spawning and incubation periods for inhabiting species

b. *Escherichia coli* per 100 milliliters (mL)

c. If above single sample trigger, a geometric mean must be calculated to determine beneficial use support status.

d. Temperature exemption: Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the 90th percentile of the 7-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.

## **Appendix C. Stormwater Runoff Types**

### **Municipal Separate Storm Sewer Systems**

Polluted stormwater runoff is commonly transported through MS4s, from which it is often discharged untreated into local water bodies. An MS4, according to (40 CFR 122.26(b)(8)), is a conveyance or system of conveyances that meets the following criteria:

- Owned by a state, city, town, village, or other public entity that discharges to waters of the U.S.
- Designed or used to collect or convey stormwater (including storm drains, pipes, ditches, etc.)
- Not a combined sewer
- Not part of a publicly owned treatment works (sewage treatment plant)

To prevent harmful pollutants from being washed or dumped into an MS4, operators must obtain a NPDES permit from EPA, implement a comprehensive municipal stormwater management program (SWMP), and use best management practices (BMPs) to control pollutants in stormwater discharges to the maximum extent practicable.

### **Industrial Stormwater Requirements**

Stormwater runoff picks up industrial pollutants and typically discharges them into nearby water bodies directly or indirectly via storm sewer systems. When facility practices allow exposure of industrial materials to stormwater, runoff from industrial areas can contain toxic pollutants (e.g., heavy metals and organic chemicals) and other pollutants such as trash, debris, and oil and grease. This increased flow and pollutant load can impair water bodies, degrade biological habitats, pollute drinking water sources, and cause flooding and hydrologic changes, such as channel erosion, to the receiving water body.

### **Multi-Sector General Permit and Stormwater Pollution Prevention Plans**

In Idaho, if an industrial facility discharges industrial stormwater into waters of the U.S., the facility must be permitted under EPA's most recent MSGP. To obtain an MSGP, the facility must prepare a stormwater pollution prevention plan (SWPPP) before submitting a notice of intent for permit coverage. The SWPPP must document the site description, design, and installation of control measures; describe monitoring procedures; and summarize potential pollutant sources. A copy of the SWPPP must be kept on site in a format that is accessible to workers and inspectors and be updated to reflect changes in site conditions, personnel, and stormwater infrastructure.

### **Industrial Facilities Discharging to Impaired Water Bodies**

Any facility that discharges to an impaired water body must monitor all pollutants for which the water body is impaired and for which a standard analytical method exists (see 40 CFR Part 136).

Also, because different industrial activities have sector-specific types of material that may be exposed to stormwater, EPA grouped the different regulated industries into 29 sectors, based on

their typical activities. Part 8 of EPA's MSGP details the stormwater management practices and monitoring that are required for the different industrial sectors. DEQ anticipates including specific requirements for impaired waters as a condition of the 401 certification. The MSGP will detail the specific monitoring requirements.

### **TMDL Industrial Stormwater Requirements**

When a stream is on Idaho's §303(d) list and has a TMDL developed, DEQ may incorporate a wasteload allocation for industrial stormwater activities under the MSGP. However, most load analyses developed in the past have not identified sector-specific numeric wasteload allocations for industrial stormwater activities. Industrial stormwater activities are considered in compliance with provisions of the TMDL if operators obtain an MSGP under the NPDES program and implement the appropriate BMPs. Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations. The next MSGP will have specific monitoring requirements that must be followed.

### **Construction Stormwater**

The CWA requires operators of construction sites to obtain permit coverage to discharge stormwater to a water body or municipal storm sewer. In Idaho, EPA has issued a general permit for stormwater discharges from construction sites.

### **Construction General Permit (GGP) and Stormwater Pollution Prevention Plans (SWPPP)**

If a construction project disturbs more than 1 acre of land (or is part of a larger common development that will disturb more than 1 acre), the operator is required to apply for a CGP from EPA after developing a site-specific SWPPP. The SWPPP must provide for the erosion, sediment, and pollution controls they intend to use; inspection of the controls periodically; and maintenance of BMPs throughout the life of the project. Operators are required to keep a current copy of their SWPPP on site or at an easily accessible location.

### **TMDL Construction Stormwater Requirements**

When a stream is on Idaho's §303(d) list and has a TMDL developed, DEQ may incorporate a gross wasteload allocation for anticipated construction stormwater activities. Most loads developed in the past did not have a numeric wasteload allocation for construction stormwater activities. Construction stormwater activities are considered in compliance with provisions of the TMDL if operators obtain a CGP under the NPDES program and implement the appropriate BMPs. Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations. The CGP has monitoring requirements that must be followed.

### **Postconstruction Stormwater Management**

Many communities throughout Idaho are currently developing rules for postconstruction stormwater management. Sediment is usually the main pollutant of concern in construction site stormwater. DEQ's *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties* (DEQ 2005) should be used to select the proper suite of BMPs for the specific site, soils, climate, and project phasing in order to sufficiently meet the standards and requirements of

the CGP to protect water quality. Where local ordinances have more stringent and site-specific standards, those are applicable.

## Appendix D. Pollutant Trading

Pollutant trading (also known as water quality trading) is a contractual agreement to exchange pollution reductions between two parties. Pollutant trading is a business-like way of helping to solve water quality problems by focusing on cost-effective, local solutions to problems caused by pollutant discharges to surface waters. Pollutant trading is one of the tools available to meet reductions called for in a TMDL where point and nonpoint sources both exist in a watershed.

The appeal of trading emerges when pollutant sources face substantially different pollutant reduction costs. Typically, a party facing relatively high pollutant reduction costs compensates another party to achieve an equivalent, though less costly, pollutant reduction.

Pollutant trading is voluntary. Parties trade only if both are better off because of the trade, and trading allows parties to decide how to best reduce pollutant loadings within the limits of certain requirements.

Pollutant trading is recognized in Idaho's water quality standards at IDAPA 58.01.02.055.06. DEQ allows for pollutant trading as a means to meet TMDLs, thus restoring water quality limited water bodies to compliance with water quality standards. DEQ's Water Quality Trading Guidance sets forth the procedures to be followed for pollutant trading (DEQ 2016b).

### Trading Components

The major components of pollutant trading are trading parties (buyers and sellers) and credits (the commodity being bought and sold). Ratios are used to ensure environmental equivalency of trades on water bodies covered by a TMDL. All trading activity must be recorded in the trading database by DEQ or its designated party.

Both point and nonpoint sources may create marketable credits, which are a reduction of a pollutant beyond a level set by a TMDL:

- Point sources create credits by reducing pollutant discharges below NPDES effluent limits set initially by the wasteload allocation.
- Nonpoint sources create credits by implementing approved BMPs that reduce the amount of pollutant runoff. Nonpoint sources must follow specific design, maintenance, and monitoring requirements for that BMP; apply discounts to credits generated, if required; and provide a water quality contribution to ensure a net environmental benefit. The water quality contribution also ensures the reduction (the marketable credit) is surplus to the reductions the TMDL assumes the nonpoint source is achieving to meet the water quality goals of the TMDL.

### Watershed-Specific Environmental Protection

Trades must be implemented so the overall water quality of the water bodies covered by the TMDL are protected. To do this, hydrologically based ratios are developed to ensure trades between sources distributed throughout TMDL water bodies result in environmentally equivalent or better outcomes at the point of environmental concern. Moreover, localized adverse impacts to water quality are not allowed.

## **Trading Framework**

For pollutant trading to be authorized, it must be specifically mentioned within a TMDL document. After adoption of an EPA-approved TMDL, DEQ, in concert with the WAG, must develop a pollutant trading framework document. The framework would mesh with the implementation plan for the watershed that is the subject of the TMDL. The elements of a trading document are described in DEQ's pollutant trading guidance (DEQ 2016b).

## **Appendix E. Public Participation and Public Comments**

This TMDL addendum was developed with participation from the Bear River Basin Advisory Group, the Oneida Soil and Water Conservation District, the US Forest Service, the Bureau of Land Management, and the Natural Resource Conservation Service.

No comments were received during the public comment period.

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## **Appendix F. Distribution List**

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